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ENERGY CONSUMPTION BY INDUSTRIES IN
SUPPORT OF NATIONAL DEFENSE: AN
ENERGY DEMAND MODEL

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Rand Corporation

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As part of a larger study on the effects of energy shortage on national defense, examines indirect military energy consumption--energy used by the manufacturing and transportation sectors of the economy in support of DoD activities for 1965 and 1967-1970. The methodology is based on input/output analysis, using a DoD spending vector based on procurement data, and an energy matrix based on the 82-sector U.S. Input/Output Table and 1963 flow data. The elements of the energy matrix are expressed in Btu per dollar of final demand. The largest energy users were (1) transportation, (2) aircraft and parts, (3) petroleum refining and products, (4) ordnance, and (5) electrical equipment and supplies. Total energy intensity (Btu consumed divided by DoD spending) was 0.0572 Btu/\$, higher than for the United States as a whole (0.0482 Btu/\$), but lower for manufacturing alone. Total consumed is estimated at 1870 to 2323 trillion Btu, about the same as the 2000 trillion Btu used by the DoD directly. 69 pp. Ref. (MW)

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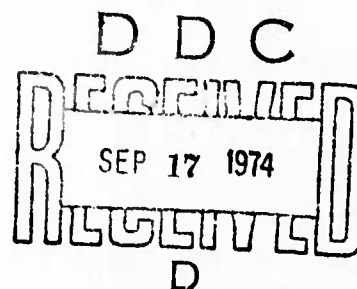
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Energy Consumption by Industries in Support of National Defense: An Energy Demand Model

C. C. Mow and J. K. Ives

A Report prepared for
DEFENSE ADVANCED RESEARCH PROJECTS AGENCY



PREFACE

This work was initiated in October 1972 as a part of the Rand research program on energy availability and national security being conducted for the Defense Advanced Research Projects Agency. The program deals with the implications of the energy shortage for Department of Defense (DoD) operation, force postures, and long-range planning decisions.

Energy in various forms is necessary for the functioning of all military systems. Energy not only is used directly as fuel for weapon systems or for logistic systems but is essential for basing support and other ancillary activities relating to the functions of the military. Energy is also used by industry in direct support of defense needs. Clearly, then, energy is a vital input into national defense activities.

This report is a part of several studies on direct and indirect military energy consumption. The report examines the latter, i.e., energy used by the manufacturing and transportation sectors of the U.S. economy in support of DoD activities. Estimates are given of energy usage by various industries in support of DoD activities for 1965 and 1967 through 1970.

The methodology applied in this report is sufficiently general so that it may lend itself to estimating future industrial energy requirements for various DoD force postures and to analyzing various energy policies in a more energy-austere environment than at present.

The methodology should be useful to energy analysts in the DoD Office of the Director for Energy, Assistant Secretary (Installations and Logistics), and to military planners and systems analysts in the Office of the Assistant Chief of Staff, Studies and Analysis, Headquarters USAF.

SUMMARY

This report is part of a larger study designed to develop ways of estimating Department of Defense (DoD) energy requirements. The objective of the study is to develop methods of estimating the amount of energy required for the following two distinct types of DoD consumption:

1. Direct energy consumption by the defense force.
2. Indirect energy consumption, i.e., the energy consumed by industry in filling DoD's needs for goods and services.

The method developed in this report is for estimating DoD's indirect energy consumption. It is similar to that developed elsewhere for estimating the energy cost of goods and services in the United States. Basically, we used the technique of Input/Output (I/O) analysis; therefore, any of the shortcomings associated with the I/O technique are inherent in this method.

There are two main parts of the method: One part is the energy matrix, and the other is the DoD spending vector. The energy matrix is based on the 82-sector 1963 U.S. Input-Output Table and 1963 flow data. The elements in the energy matrix are expressed in Btu per dollar of final demand. The DoD spending vector is derived from published DoD procurement data. We categorized the DoD procurement data into 82 sectors that are compatible with the energy matrix. The method allows one to estimate both the amount of energy required to produce goods for each sector of final demand and the total amount used by industry in support of DoD.

Results for 1965 and 1967 through 1970 were obtained. They show that the transportation, aircraft and parts, petroleum refining and products, ordnance, and electrical equipment and supplies sectors are the five largest energy users. Compared with the U.S. economy as a whole, the results show that the total energy intensity, i.e., the total amount of energy consumed, divided by DoD spending (or BTU per

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dollar), was, in 1970, higher for DoD (0.0572 Btu/\$) than for the United States as a whole (0.0482 Btu/\$). If one considers only the manufacturing sectors, then one finds that the DoD has a lower energy intensity (0.0512 Btu/\$) than the United States (0.0634 Btu/\$). For the years 1967 through 1970, the part of the DoD budget that is of interest in this report represents about 4.4 to 5.6 percent of GNP, while energy consumption ranges from 5.4 to 6.8 percent of corresponding U.S. consumption. Estimates of the amount of energy used ranged from 1870 trillion Btu to 2323 trillion Btu. This is about the same amount of energy used directly by DoD, which is about 2000 trillion Btu.

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I. INTRODUCTION

For many decades the United States has enjoyed access to abundant low-cost supplies of domestic energy. These fuel resources have contributed significantly to the country's economic growth, national security, and quality of life. But abundant domestic supplies of low-cost energy can no longer be taken for granted in the United States. Concern for the supply of energy has been evidenced in the past two to three years by the large number of studies sponsored by various government agencies. This concern has culminated in the administration's recent establishment of the Federal Energy Office and the Energy Research and Development Council to address this critical problem.

Energy is, of course, intimately related to national security in the general sense that our economy and way of life are dependent on access to adequate energy supplies. Energy, however, is not only related to national security in this general sense, but also in the specific sense that it is essential for daily operation of all military systems. Much of our force posture is built around the concept of mobility and speed. Over the years, our forces have become more energy intensive as they became more mechanized and more mobile. Furthermore, the trend toward ever higher speed and increased mobility suggests that our military forces will be even more energy intensive in the future. For example, a mechanized infantry battalion currently uses almost 6 times more energy than a regular infantry battalion, and as speeds and weights of aircraft and other vehicles increase, their fuel consumption rates will likewise increase.

Direct energy consumption by our military forces, i.e., fuel consumption by military systems, is only a part of the energy picture for the Department of Defense (DoD). For the DoD to maintain its force posture, it must depend on U.S. industry to supply military goods, equipment, and services. Thus, the DoD uses energy indirectly in that it depends on industry to supply the necessary hardware and services.

To properly assess the impact of the energy shortage on national security, it is essential to have an insight into how energy is used

in support of the military. Work is currently under way to examine both the direct and indirect energy demand by the military. The objective of this report is to estimate the indirect energy demand, i.e., the energy used by industry in supplying the nation's defense needs for goods and services. The method used allows the effect on energy requirements of changes in defense spending to be estimated. It may also be used to estimate the energy savings resulting from alternative energy conservation or force planning policies.

This method presents a very broad picture of total energy requirements. By providing a perspective, it can, thus, provide a basis for choosing which areas of defense expenditures might be analyzed in greater detail.

II. METHODOLOGY

BACKGROUND

It is estimated that 80 percent of all U.S. energy is consumed by the commercial, industrial, and transportation sectors [1]. About two-thirds of the DoD budget is spent in these three sectors, while about one-third is for wages and salaries [2,3]. With this information, and assuming that DoD needs for energy are the same as the total economy, it is possible to estimate very roughly how much energy is used by industry to produce goods and services for the DoD, E_{DoD} , as follows:

$$E_{\text{DoD}} = \frac{0.67\text{DoD}}{\text{GNP}} \times 0.80E ,$$

where E = total U.S. energy consumption,

DoD = total DoD budget,

GNP = total Gross National Product.

We know, however, that the energy required to produce a unit of goods or services varies a great deal from one type of good or service to another [4]. For example, the amount of energy required to process different materials commonly used in defense industries can vary by two orders of magnitude. Some of the typical direct energy requirements are shown in Table 1.

Another example of large differences in energy requirements is in energy usage by the various transportation modes. Table 2 illustrates energy intensity for various intercity freight transport modes.

It is clear that there is a difference of two orders of magnitude between the energy intensities of the most and least intensive modes of freight transportation. Clearly, great differences in total energy consumption can result from changes in the relative utilization levels of the various modes of transportation.

Similar examples can also be found in the manufacturing sector of the U.S. economy. Energy intensity (defined either as Btu per dollar of output or Btu per dollar of value added) in this sector has been

Table 1

ENERGY REQUIRED TO PROCESS A TON
OF SELECTED MATERIALS

Material	Energy Required for Processing	
	KWh/ton	10 ⁶ Btu/ton
Titanium	150,000	511.8
Aluminum	22,000	75.1
Zinc	14,000	47.8
Copper	11,700	39.9
Lead	9,200	31.4
Iron and steel	7,600	25.9
Glass	5,000	17.1
Cement	2,900	9.9
Plastics	2,900	9.9
Nickel	2,000	6.8

SOURCE: Reference 5.

Table 2

TWO COMPUTATIONS OF THE ENERGY INTENSITY OF
VARIOUS INTERCITY FREIGHT MODES

Freight Mode	Reference 7 (Btu/ton-mi)	Reference 6 (Btu/ton-mi)
Waterway	500	540
Rail	750	680
Pipeline ^a	1,850	450
Truck	2,400	2,340
Air cargo ^a	63,000	37,000

SOURCE: References 6 and 7.

^aThe large discrepancy between the two sets of numbers is due to the method of calculation; we believe the number given by Ref. 7 is more representative of the energy intensity.

examined by a number of investigators [4,8,9], and information on the fuels and electrical energy consumed by manufacturing industries is compiled and published by the Department of Commerce [10]. Table 3 illustrates the variation in energy intensities among some of these industries. For example, note that the amount of energy used to produce a dollar of output in the transportation equipment sector is only one-thirtieth of the amount required to produce a dollar of output in the primary iron and steel sector.

Table 3

DIRECT ENERGY^a INTENSITY IN
SELECTED INDUSTRIES

(10⁶ Btu/1958 dollar output)

Industry	Energy Intensity
Petroleum refining	0.14698
Construction	0.01204
Primary iron and steel	0.14880
Transportation equipment	0.00487
Communications	0.00823

SOURCE: Reference 4.

^aDirect energy is defined as the energy used by the manufacturing sector, exclusive of its supporting industries.

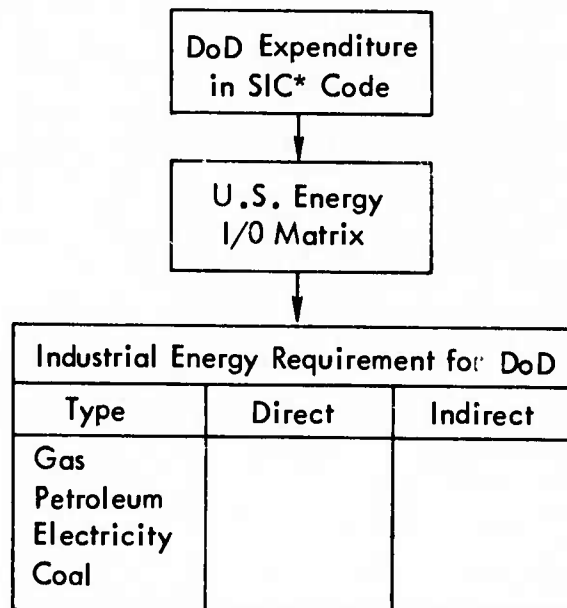
The above examples illustrate some of the difficulties that may exist in trying to determine the amount of energy used by industry in support of military needs. An additional difficulty, as shall be seen in the following section, is that DoD spending is spread across many different industries but not necessarily in the same proportion as total U.S. spending.

GENERAL FRAMEWORK

The approach used to develop the method described in this report combines some earlier work on DoD spending [2,3] with an input/output model adapted for energy analysis work [8,9]. Figure 1 shows a

schematic of the model used to determine the energy used by industry for DoD support.

The mechanics of determining the amount of energy consumed by industries in support of DoD, as depicted by Fig. 1, follow the well-established procedures of input/output (I/O) analysis. In this case, a vector of DoD's expenditures and an I/O matrix are required. The expenditures constitute the vector of final demand; and the energy I/O matrix is the equivalent of the interindustry transaction matrix, except that energy flows are measured in terms of real physical units. The matrix allows one to calculate the amount of energy required to produce a given dollar of final demand. Once the vector and the matrix are determined, energy consumption by industry for DoD-support activities can be determined in a straightforward manner.



* SIC is Standard Industrial Classification as expressed in producer prices. The purchase price is equal to sum of the producer price, wholesale and retail trade margins, and transportation costs.

Fig. 1 — Schematic of model used to determine energy consumed by industry for DoD support

DEPARTMENT OF DEFENSE EXPENDITURES VECTOR

There are three commonly accepted defense spending accounts [11]. For clarity, we shall briefly describe each, as follows, and also describe the defense spending categories used in this report:

1. *Military Budget or Military Outlay.* This is the outlay for DoD functions plus military assistance to foreign countries.
2. *National Defense Outlay.* National Defense Outlay is defined in the President's Budget as the military budget plus budgets for the Atomic Energy Commission, stockpiling, Selective Service, and other defense-related activities.
3. *NIA Defense Purchases.* This account is the national defense purchases of goods and services in the National Income and Product account. It is equal to the National Defense Outlay minus military retirement pay, adjusted for timing and other factors.

Although the three accounts closely approximate each other, there are, nonetheless, clear distinctions among them, particularly in terms of which agencies normally use them. The National Defense Outlay account is commonly used in the President's Budget and by the Treasury Department. DoD normally uses the Military Outlay account as its budget. In analyzing the effects of defense spending on the economy, GNP, etc., the account most frequently used is NIA Defense Purchases. It is the NIA Defense Purchases account that is the measure we will depend on most heavily to carry out the energy consumption analysis.

The defense expenditures vector used in this report come, primarily, from Refs. 2, 3, and 12, with additional information detail from Ref. 13. In Ref. 12, defense expenditures included only the military expenditures of the DoD and the military assistance program, excluding DoD civilian functions.

Various DoD documents, expenditures series, plans and budgets, backup data, military contract awards, and the census of shipments of the defense industries [14] were used to allocate defense expenditures to various categories. From examination of Refs. 2, 3, and 12 and in

discussions with their authors, it appears that, wherever possible, each expenditure is assigned to a four-digit Standard Industrial Classification (SIC) Code. DoD expenditures, thus classified, conform almost exactly to the industry classification used in the two-digit I/O Table for 1963 [15]. Minor deviations from the 1963 I/O Table classification are noted.

Table 4, from Ref. 3, shows how defense expenditures for the Fiscal Years 1968, 1969, and 1970 are aggregated from the four-digit SIC Code to the two-digit industry classification of the 1963 I/O Table. All expenditures are deflated to 1958 dollars.

Examination of Table 4 shows that certain specific DoD expenditures dominate, while many items represent only a very minor portion of the spending. Therefore, since most of the DoD budget is spent at a small number of selected manufacturers (more on this later), it is desirable to both aggregate and disaggregate Table 4 for those industries in which there might be a large variation in energy intensity. Since we are particularly interested in determining the amount of energy consumed by the industries (manufacturers) in support of DoD, we will focus our attention more on the so-called "defense-oriented industry." A more appropriate expenditure vector, one which will be more responsive to the purpose of the present report, is the 40-item group shown in Table 5, which was aggregated from the data in Table 4.

Table 5 relates the industry classification used in this report to the industry classification of the 1963 I/O Table, as well as to the SIC Code. As Table 5 shows, most of the items can be categorized into a two-digit SIC Code; some may include two two-digit SIC Code items. Several major items, however, required more detail than the two-digit code provides; these are the aircraft and parts and primary metals, ferrous and nonferrous, items.

Defense expenditure vectors in 1958 dollars for Fiscal Years 1965 and 1967 through 1970 are shown in Table 6. Table 7 shows the 15 largest expenditures by DoD for the corresponding years. Note that the sum of the 15 largest expenditures represents almost 95 percent of total DoD spending. The largest expenditure is always government compensation (military and civilian payroll). The second largest

Table 4

DEFENSE EXPENDITURES, FISCAL YEARS 1968, 1969, AND 1970
(In millions of 1958 dollars, producers' prices^a)

Sectors	1968	1969	1970	Sectors	1968	1969	1970
Total	60,784.0	58,548.0	52,697.0	Stampings, screw machine products, and bolts	37.3	31.0	24.7
Agriculture, forestry, and fisheries	204.7	216.5	173.3	Other fabricated metal products	100.0	75.0	49.5
Livestock and livestock products	121.0	130.0	96.0	Engines and turbines	241.0	215.2	172.8
Other agricultural products	72.0	75.0	67.0	Farm machinery and equipment	42.0	3.9	3.6
Forestry and fishery products	4.0	3.0	2.0	Construction, mining, and oil field machinery	189.3	146.1	113.8
Agricultural, forestry, and fishery services	7.7	8.5	8.3	Materials handling machinery and equipment	155.0	133.1	110.0
Mining	27.3	34.3	29.7	Metal working machinery and equipment	82.1	67.4	52.4
Iron and ferroalloy ores mining	0.2	0.2	0.2	Special industry machinery and equipment	16.8	13.2	14.6
Nonferrous metal ores mining	0.2	0.1	0.1	General industrial machinery and equipment	143.1	114.8	111.7
Coal mining	26.5	33.6	29.1	Machine shop products	74.9	64.8	61.9
Crude petroleum and natural gas	0.1	0.1	0.1	Office, computing, and accounting machines	285.0	293.0	280.0
Stone and clay mining and quarrying	0.1	0.1	0.1	Service industry machines	108.4	85.5	71.6
Chemical and fertilizer mineral mining	0.2	0.2	0.1	Electric, industrial equipment and apparatus	457.0	366.8	354.3
Construction	1,451.2	1,460.0	1,130.4	Household appliances	14.4	11.3	8.5
New construction	800.0	849.0	584.2	Electric lighting and wiring equipment	32.5	29.8	25.2
Maintenance and repair construction	651.2	611.4	546.2	Radio, television, and communication equipment	5,265.0	5,034.0	4,704.0
Manufacturing	30,666.9	28,848.8	24,635.2	Miscellaneous electrical machinery, equipment and supplies	496.7	478.3	397.0
Ordnance and accessories	6,152.3	6,514.0	5,144.6	Miscellaneous electrical machinery, equipment and supplies	115.0	107.0	85.0
Food and kindred products	1,321.0	1,152.0	897.0	Motor vehicles and equipment	973.2	719.0	673.0
Tobacco manufactures	...	...	...	Aircraft and parts	8,798.3	7,926.1	6,831.0
Broad and narrow fabrics, yarn and thread mills	183.4	141.0	110.0	Other transportation equipment	1,095.0	1,125.0	1,073.0
Miscellaneous textile goods and floor coverings	48.2	33.1	25.0	Scientific and controlling instruments	394.7	354.0	314.0
Apparel	303.2	241.0	163.0	Optical, ophthalmic, and photographic equipment	400.0	375.0	328.0
Miscellaneous fabricated textile products	95.3	69.4	48.7	Miscellaneous manufacturing	17.2	15.1	13.0
Lumber and wood products, except containers	12.7	10.6	8.3	Transportation	3,108.8	2,803.0	2,510.2
Wooden containers	17.3	10.2	8.7	Communications	376.0	325.0	350.0
Household furniture	16.4	11.8	9.3	Electric, gas, water, and sanitary services	240.5	252.1	239.7
Other furniture and fixtures	23.2	16.1	14.8	Wholesale and retail trade	1,023.0	905.3	829.0
Paper and allied products except containers	26.2	23.0	21.0	Finance, insurance, and real estate	86.8	87.9	86.1
Paperboard containers and boxes	26.1	21.7	18.0	Finance and insurance	17.5	16.7	15.1
Printing and publishing	226.0	190.6	178.5	Real estate and rental	69.3	71.2	70.0
Chemicals and selected chemical products	512.0	507.0	425.0	Services	2,173.4	2,087.8	1,975.8
Plastics and synthetic materials	21.0	16.3	15.0	Hotels; personal and repair services, except auto	345.5	353.0	329.8
Drugs, cleaning and toilet preparations	130.2	95.3	87.2	Business services	615.0	625.0	620.0
Paints and allied products	23.2	16.1	14.8	Research and development	538.0	480.0	435.0
Petroleum refining and related industries	1,414.0	1,430.0	1,181.0	Automobile repair and service	19.7	16.1	14.7
Rubber and miscellaneous plastics products	219.9	172.0	143.0	Amusements	120.2	118.7	96.3
Leather tanning and industrial leather products	0.5	0.4	0.3	Medical, educational services, and nonprofit organizations	535.0	495.0	480.0
Footwear and other leather products	78.4	65.2	53.0	Government enterprises	76.0	78.4	76.7
Glass and glass products	13.1	10.7	9.1	Federal government enterprises	63.3	65.4	64.2
Stone and clay products	15.3	13.7	13.7	State and local government enterprises	12.7	13.0	12.5
Primary iron and steel manufacturing	88.2	65.4	53.2	Imports	2,364.6	2,373.8	2,239.0
Primary nonferrous metals manufacturing	103.7	79.4	63.1	Other	102.8	105.0	100.9
Metal containers	18.5	12.3	11.8	Government compensation	18,882.0	18,970.0	18,321.0
Heating, plumbing, and structural metal products	105.0	126.3	106.6				

SOURCE: Reference 3, p. 10.

NOTE: Expenditure totals differ from national income totals in that adjustments for timing and receipts netted against expenditures have not been made in order to provide more realistic employment estimates.

^aProducers' prices exclude the distribution costs of transportation and trade. These are included in the totals for transportation and trade.

Table 5
DEFENSE EXPENDITURE CLASSIFICATION FOR 40 SECTORS

Sector	Industry Classification, 1963 I/O	SIC Code
1. Agriculture, forestry, and fisheries	1-4	0112, 0113, 0119, 0122, 0123, 0132, 0133, 0139, 014, 0192, 0193, 02, 071, 0723, 0729, 073, 074, 081-086, 091, 098
2. Mining	5-10	1011, 102-106, 108, 109, 11, 12, 1311, 1312, 141, 142, 144, 145, 148, 149, 147
3. Construction	11, 12	pt. 15, 16, 17, 138, 6561
4. Ordnance	13	19
5. Food and kindred products	14, 15	20, 21
6. Fabrics and textiles	16, 17	22
7. Apparel and fabricated textiles	18, 19	23
8. Lumber and wood products	20, 21	24
9. Furniture and fixtures	22, 23	25
10. Paper and allied products	24, 25	26
11. Printing and publishing	26	27
12. Chemical and allied products	27-30	28
13. Petroleum refining and products	31	29
14. Rubber and plastic products	32	30
15. Leather and leather products	33, 34	31
16. Glass, stone, and clay products	35 36	32
17. Primary iron and steel manufacturing	37	331, 332, 3391, 3399
18. Primary nonferrous metals manufacturing	38	333, 3341, 335, 336, 3392
19. Fabricated metal products	39-42	34
20. Engines and turbines	43	351
21. Farm machinery and equipment	44-52	35 (except 351)
22. Electrical equipment and supplies	53-58	36
23. Motor vehicles and equipment	59	371
24. Aircraft and parts	60	372
25. Other transportation equipment	61	373-375, 379
26. Instruments and optical equipment	62-64	38, 39
27. Air passenger transportation service	65	
28. Air cargo transportation service	65	
29. Vessel transportation service	65	
30. Rail and motor transportation service	65	
31. General transportation, warehousing	65	
32. Communication	66, 67	
33. Utilities	68	
34. Wholesale, retail	69	
35. Finance	70, 71	
36. General services	72-77	
37. Government enterprise	78, 79	
38. Import	80	
39. Other	81	
40. Government compensation	82	

Table 6

DEFENSE EXPENDITURE VECTORS, FISCAL YEARS 1965 AND 1967 THROUGH 1970
(In \$ millions)

Sector	1965		1967		1968		1969		1970	
	\$	%	\$	%	\$	%	\$	%	\$	%
1	130.5	0.3	154.0	0.3	204.7	0.3	216.5	0.4	173.3	0.3
2	28.7	...	26.9	...	27.3	...	34.3	...	29.7	...
3	1595.0	4.0	1846.0	3.4	1451.2	2.3	1460.4	2.5	1130.4	2.2
4	2463.5	6.1	4714	8.6	6152.3	10.1	6514	11.1	5144.6	9.8
5	564.4	1.4	1049.6	1.9	1321	2.2	1152	2.0	897	1.7
6	101.3	0.3	299.1	0.5	231.6	0.4	174.1	0.3	135	0.3
7	133.7	0.3	430.8	0.8	398.5	0.7	300.4	0.5	211.7	0.4
8	7.6	...	47.4	0.1	30	...	20.8	...	17	...
9	29.2	...	47.0	0.1	39.6	0.1	27.9	...	24.1	...
10	30.0	...	68	0.1	52.3	0.1	44.7	0.1	39	0.1
11	139	0.3	137	0.2	226	0.4	190.6	0.3	178.5	0.4
12	353.9	0.9	736.8	1.3	686.4	1.1	634.7	1.1	542	1.0
13	627.3	1.6	908.9	1.6	1414.0	2.3	1430	2.4	1181	2.2
14	113.9	0.3	183.6	0.3	219.9	0.4	172	0.3	143	0.3
15	29.4	...	98	0.2	78.9	0.1	65.6	0.1	53.3	0.1
16	13.8	...	23.9	...	25.6	...	26	...	22.8	...
17	37.6	...	101.8	0.2	88.2	0.2	65.4	0.1	53.2	0.1
18	57.5	0.1	120.7	0.2	103.7	0.2	79.4	0.1	63.1	0.1
19	83.3	0.2	203.4	0.4	260.8	0.4	244.6	0.4	192.6	0.4
20	121.8	0.3	218.8	0.4	241	0.4	215.2	0.4	172.8	0.3
21	586.6	1.5	1021.8	1.8	1096.6	1.8	921.8	1.6	819.6	1.6
22	4318.8	10.8	5390.9	9.8	6380.6	10.5	6057.2	10.3	5574	10.6
23	514	1.3	917.3	1.7	973.2	1.6	719	1.2	623	1.2
24	6102.3	15.2	8113.5	14.8	8798.3	14.5	7926.1	13.5	6831	13.0
25	928	2.3	1049.3	1.9	1095	1.8	1125	1.9	1073	2.0
26	404.8	1.0	535.3	1.0	811.9	1.3	744.1	1.3	655	1.2
27 ^a	...	...	...	...	...	...	398.9	0.69	385.7	0.73
28 ^a	...	...	...	...	...	...	181.8	0.31	128.9	0.24
29 ^a	...	...	...	...	...	...	759.9	1.30	791.9	1.50
30 ^a	...	...	...	...	...	...	52.8	0.09	51.7	0.10
31 ^a	1035 ^b	2.6	2542.4 ^b	4.6	3108.8	5.1	1409.6 ^c	2.41	1152.5 ^c	2.19
32	249	0.6	310.2	0.6	376	0.6	325	0.6	350	0.7
33	148.5	0.4	176.8	0.3	240.5	0.4	252	0.4	239.7	0.4
34	525	1.3	721.2	1.3	1023.0	1.7	905	1.5	829	1.6
35	82.7	0.2	87	0.1	86.8	0.1	87.9	0.2	86.1	0.2
36	1971.3	4.9	2310.1	4.2	2173.4	3.6	2087.8	3.6	1975.8	3.7
37	53.6	0.1	64.4	0.1	76.0	0.1	78.4	0.1	76.7	0.1
38	1513.0	3.8	2239.0	4.1	2364.6	3.9	2373.8	4.1	2239	4.2
39	85.2	0.2	100.2	0.2	102.8	0.2	105	0.2	100.9	0.2
40	15038	37.4	17950	32.7	18882	31.1	18970	32.5	18321	34.8
Total	40,216	100.0	54,947	100.0	60,784	100.0	58,548	100.0	52,697	100.0

^aDetail cost for sectors 27-31 derived from Refs. 2, 3, and 13.

^bNo breakdown available.

^cNo detail breakdown available.

Table 7

RANKING OF THE FIFTEEN LARGEST DEPARTMENT OF DEFENSE EXPENDITURES AND THEIR PERCENTAGES OF TOTAL DEPARTMENT OF DEFENSE SPENDING

Sector	1965		1967		1968		1969		1970	
	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
3. Construction	6	4.0	8	3.4	8	2.3	8	2.5	9	2.2
4. Ordnance	4	6.1	4	8.6	4	10.1	3	11.1	4	9.8
5. Food and kindred products	12	1.5	9	2.0	10	2.2	10	2.0	11	1.7
13. Petroleum	10	1.5	12	1.5	9	2.3	9	2.4	8	2.2
21. Machinery except electrical engines and turbines	11	1.5	11	1.8	11	1.8	12	1.6	12	1.6
22. Electrical equipment and supplies	3	10.8	3	9.8	3	10.5	4	10.3	3	10.6
23. Motor vehicles and equipment	14	1.3	11	1.7	14	1.6	15	1.2	15	1.2
24. Aircraft and parts	2	15.0	2	15.0	2	14.5	2	13.5	2	13.0
25. Other transportation	9	2.5	10	2.0	12	1.8	11	1.9	10	2.0
26. Instruments	15	1.0	15	1.0	15	1.3	14	1.3	14	1.2
27.-31. Transportation	8	2.6	5	4.6	5	5.1	5	4.8	5	4.8
34. Wholesale, retail	13	1.5	14	1.3	13	1.7	13	1.5	13	1.6
36. Services	5	4.9	6	4.2	7	3.6	7	3.6	7	3.7
39. Import	7	3.8	7	4.1	6	3.9	6	4.1	6	4.2
40. Government compensation	1	37.4	1	32.7	1	31.1	1	32.5	1	34.8
Total		95.4		93.7		93.8		94.3		94.6

expenditure in these years was for aircraft and parts. Since we are only interested in the energy consumption by industries in support of DoD activities, not the details of defense budgets, we believe that the DoD expenditure vector shown in Table 6 is sufficiently detailed for our purpose.

ENERGY I/O MATRIX

The second major part of the model is the energy I/O matrix. As stated earlier, the energy matrix enables us to determine how much total energy is used to produce a dollar of final demand. It is not enough merely to look at the direct energy consumption of a given producer or industry because our industrial-economic system involves a highly complicated interchange between the production, transportation, and commercial sectors before a finished product is sold to the final consumer. For instance, an automobile manufacturer will purchase fabricated metal, which in turn was smelted by a primary metals industry, which obtained the necessary ores from the mining industries. In order to have any real idea of the total energy required by a given industry, it is necessary to ascertain what the total inputs to that industry are. To help accomplish this, the Bureau of the Census has published an interindustry model (also called an I/O matrix) [15] to indicate the relationship between the inputs to an industry and the resultant sales to other industries and final demand.

I/O TABLE

To illustrate the relationship of the I/O matrix to the total economic picture, a small version of an I/O Table is presented in Fig. 2. The shaded part is the I/O matrix.

The columns in the figure represent the dollar inputs into that industry from each of the other producers and the value added by that industry through labor, return on investment, and taxes. The row entries represent the dollar sales of a producer to another producer (or to itself) and sales to final demand. Theoretically, the sum of the rows should equal the sum of the columns or, in other words, the total value of the product produced by an industry. To total the output from all

		Producers								Final Demand			
		Agriculture	Mining	Construction	Manufacturing	Trade	Transportation	Services	Other	Persons	Capital	Net Exports	Government
Producers	Agriculture												
	Mining												
	Construction												
	Manufacturing												
	Trade												
	Transportation												
	Services												
	Other												
Value Added	Employee Compensation									Gross National Product			
	Return on Investment												
	Government (taxes)												

Fig. 2 — Input-output (I/O) table (adapted from Ref. 15)

industries, however, would produce a somewhat meaningless number due to the multiple sales between producers, which results in multiple counting of the worth of a product. To determine GNP, only those sales to final demand or value added may be summed to avoid double counting.

The following equation equates total output, X_i , to final demand in dollars:

$$X_i = \sum_{j=1}^n A_{ij} X_j + Y_i, \quad (1)$$

where Y_i = output of i sold to final demand (in this case, DoD purchases),

X_j = total output of sector j , \$,

$A_{ij} = X_{ij}/X_j$, where X_{ij} = sales from sector i to sector j , obtained through statistical observations or estimation, \$.

In matrix form,

$$\underline{X} = \underline{A} \underline{X} + \underline{Y} ; \quad (2)$$

and when solved for X, yields

$$\underline{X} = (\underline{I} - \underline{A})^{-1} \underline{Y} . \quad (3)$$

where I is the identity matrix.

The Bureau of Census has put out the A and $(I - A)^{-1}$ matrix in both the 367- and 82-square matrix. For our purposes, the 82-square matrix [15] was sufficient since we were only able to disaggregate the DoD budget down to the 82-sector level. Calculations were made using an 82-square matrix and an 82-element DoD expenditure vector, but, for printout and analysis purposes, they were aggregated to form 40 sectors.

The equation in this form would give dollar flows from energy sectors to consuming industries. Quantities instead of dollars were desired, however, because the ratios of the price of electricity vary by as much as a factor of six between industries. In order to convert to quantities, Eq. (3) was modified as follows:

$$E_i = \sum_{k=1}^n E_{ik} + E_{iy} , \quad (4)$$

where E_i = total energy output of energy sector i (this does not include energy sold to another energy sector), Btu,

E_{ik} = energy sales from i to k, Btu,

E_{iy} = energy of type i sold to final demand, y, Btu.

Since

$$E_{ik} = \frac{E_{ik}}{X_k} X_k , \quad (5)$$

and

$$X_k = \sum_{m=1}^n (I - A)_{km}^{-1} Y_m, \quad (6)$$

we may express E_{ik} as

$$E_{ik} = \frac{E_{ik}}{X_k} \sum_{m=1}^n (I - A)_{km}^{-1} Y_m, \quad (7)$$

and, substituting Eq. (7) into Eq. (4), we get

$$E_i = \sum_{k=1}^n \sum_{m=1}^n \left(\frac{E_{ik}}{X_k} \right) (I - A)_{km}^{-1} Y_m + \left(\frac{E_{iy}}{Y_i} \right) Y_i. \quad (8)$$

If we define R_{ik} and S_{ik} as follows:

$$R_{ik} = \frac{E_{ik}}{X_k} \quad \text{energy intensity,}$$

$$S_{ik} = \frac{E_{iy}}{Y_i} = \begin{cases} S_{ik} & i = k = \text{energy sector} \\ 0 & \end{cases} \quad \begin{matrix} \text{Energy intensity sold} \\ \text{to final demand} \end{matrix},$$

we can express Eq. (8) in matrix notation as follows:

$$\underline{E} = [\underline{R}(\underline{I} - \underline{A})^{-1} + \underline{S}] \underline{Y}, \quad (9)$$

where the first term within the brackets, $\underline{R}(\underline{I} - \underline{A})^{-1}$, gives the amount of energy of type k to produce one dollar of final demand and the second term, \underline{S} , is the amount of energy delivered per dollar of final demand. This report is principally interested in the first term. Matrices \underline{R} and \underline{S} are described in greater detail below.

Energy Flow

In determining the energy coefficient matrix, \underline{R} , energy flows to each industrial sector are required. The main source for this information

was work reported in Ref. 9. Since we were working with an 82×82 matrix, aggregation was required in order to use the 5×362 energy matrix in Ref. 9. The matrix was developed by using 1963 data. Since the energy intensity of an industry can change considerably over time, we would like to have used more recent energy-intensity figures, but lack of time and data prevented pursuing this course.*

Determination of energy flows requires a knowledge of the quantity, E_i , of coal, crude oil, petroleum, electricity, and natural gas produced. Tabulations of energy produced by the energy sectors as given by three different sources--Herendeen [9], Reardon [8], and the *U.S. Statistical Abstract* [16]--are in Table 8. Our calculations using an energy balance to show that our energy coefficient matrix, \underline{R} , is consistent with actual production figures are also given. Appendix A contains a description of the energy balance.

Table 8
ENERGY BALANCE FOR YEAR 1963
(10^{12} Btu)

Fuel	Method 1 ^a	Method 2 ^b	Ref. 8	Ref. 9	Ref. 16
Coal	12,478	12,338	12,486	12,447	11,109
Crude oil	34,395	34,155	34,230	34,713	---
Petroleum	22,090	21,943	22,100	22,331	22,614
Electricity	3,130	3,104	3,128	3,451	2,835
Gas	13,954	13,843	13,800	15,046	16,343
Total primary	48,707 ^c	48,312 ^c	48,576	49,602	49,624

SOURCE: References 8, 9, and 16.

$$^a \underline{E}_k = \underline{R}\underline{X} + \underline{S}\underline{Y}.$$

$$^b \underline{E}_k = \underline{R}(\underline{I} - \underline{A})^{-1} \underline{Y} + \underline{S}\underline{Y}.$$

$$^c E_{\text{primary}} = E_{\text{coal}} + E_{\text{crude oil}} + 0.5948 E_{\text{electricity}}.$$

* The Division of Economic Growth of the Bureau of Labor Statistics indicated that the 1968 table may become available later in 1974.

Once total energy production is determined, the energy must be distributed by type to each industrial sector and to final demand. Determination of gas, crude oil, coal, and electricity was the easiest. For the manufacturing sector, the *Census of Manufacturers* [10] provided quantitative requirements for various forms of energy and materials used. For the other sectors and for final demand, average fuel costs were used to convert dollar purchases from the I/O Table to quantitative fuel requirements.

Oil requirements were made much more difficult since the *Census of Manufacturers* did not provide an estimate of motor gasoline, jet fuel, and diesel fuel used for internal transportation. Reference 17 did a rather thorough analysis by breaking down the products of the petroleum industry and distributing them according to their major uses. Much of the data still came from the *Census of Manufacturers*. The data on fuel used for transportation, which were taken from Ref. 17, were based largely on the number of vehicles and drivers employed by an industry.

To prevent duplication of energy requirements, those fuels sold to energy sectors to be sold in another form (e.g., petroleum refining and electricity) were not included as energy inputs to that energy sector. Therefore, no crude oil is shown as an input to the petroleum industry to avoid double counting.

Finally, an energy balance is required to ensure that energy used equals energy produced. Any differences were prorated to each of the sectors. For an explanation of the energy balance see the appendices. The resulting energy flows are shown in Table 9.

Energy Coefficients

To determine energy coefficients or direct energy intensities, R ,^{*} energy flows must be divided by total dollar output of the purchasing industry, as defined earlier. Dollar sales from Ref. 15 were used. Table 10 shows the direct energy intensities expressed in Btu per dollar sales.

* It should be noted that energy intensity is defined as Btu per dollar sales, and not as Btu per dollar value added, as is done in many publications.

Table 9

ENERGY FLOWS IN 40 SECTORS, 1963

Sector	Sales (\$ millions)	Total (10 ¹² Btu)	Electricity (10 ¹² Btu)	Petroleum (10 ¹² Btu)	Gas (10 ¹² Btu)	Coal (10 ¹² Btu)	Crude (10 ¹² Btu)
1. Agriculture	57,473.0	961.1519	46.3537	772.3174	118.6209	23.8598	0.0
2. Mining	20,568.4	1,469.0659	73.3105	126.9616	241.4668	151.8428	875.4846
3. Construction	85,310.0	994.1357	29.6376	906.9519	57.5461	0.0	0.0
4. Ordnance	6,315.0	31.1935	7.5149	4.1149	8.3863	11.1775	0.0
5. Food and kindred products	81,693.0	860.0342	67.6790	222.0581	335.2708	235.0360	0.0
6. Fabrics and textiles	17,058.0	221.4466	42.5647	59.3837	45.8862	73.6105	0.0
7. Apparel and fabricated textiles	21,073.0	59.2784	10.4223	26.8033	12.3819	9.6712	0.0
8. Lumber and wood products	11,600.0	104.1912	16.7099	47.3826	32.0383	7.8593	0.0
9. Furniture and fixtures	5,990.0	36.7472	6.0392	9.7658	8.8672	12.0770	0.0
10. Paper and allied products	18,848.0	1,124.2734	64.2766	236.7846	336.2917	486.9207	0.0
11. Printing and publishing	16,283.0	56.3833	13.9380	23.5542	16.1774	2.7140	0.0
12. Chemical and allied products	35,716.0	3,475.2893	326.9304	921.3625	1,269.9397	791.5806	165.4756
13. Petroleum refining and products	21,850.0	2,560.4031	38.6743	1,765.2598	734.8152	21.6555	0.0
14. Rubber and plastic products	10,200.0	141.9839	22.7461	31.3446	30.1104	57.7830	0.0
15. Leather and leather products	4,398.0	30.7346	2.8040	12.1323	5.7364	10.0621	0.0
16. Glass, stone, and clay products	12,488.0	994.4409	53.9069	107.1508	588.2146	245.1851	0.0
17. Primary iron and steel manufacturing	24,910.0	3,464.0808	111.1981	368.9165	631.2190	2,352.7498	0.0
18. Primary nonferrous manufacturing	15,940.0	641.1858	172.4708	85.8050	335.6958	47.2142	0.0
19. Fabricated metal products	25,377.0	205.0427	36.0283	66.6698	77.5298	24.8107	0.0
20. Engines and turbines	2,407.0	24.6043	2.8163	6.0993	3.8897	11.7991	0.0
21. Farm machinery and equipment	32,836.0	201.2311	33.9456	60.2182	60.5567	46.5109	0.0
22. Electrical equipment and supplies	30,114.0	175.0983	33.0827	51.4354	64.0566	30.5056	0.0
23. Motor vehicles and equipment	40,200.0	183.3479	32.6184	28.4816	44.7828	77.4654	0.0
24. Aircraft and parts	15,670.0	66.5456	19.8070	26.1688	10.8468	9.7232	0.0
25. Other transportation equipment	4,894.0	34.3622	5.5547	5.5563	6.9308	10.4660	5.8543
26. Instruments and optical equipment	13,992.0	84.5388	11.5766	20.4102	14.5673	20.6124	18.6543
31. General transportation, warehousing	39,460.0	3,360.6475	23.7983	2,740.4922	539.0232	57.3354	0.0
32. Communication	15,798.0	134.5966	18.6851	76.8743	39.0372	0.0	0.0
33. Utilities	29,680.0	1,320.7209	309.8589	125.5166	856.5645	28.7807	0.0
34. Wholesale, retail	120,600.0	1,829.2595	203.5729	1,152.9351	472.7512	0.0	0.0
35. Finance	79,010.0	402.2095	71.2927	144.8904	186.0264	0.0	0.0
36. General services	104,157.0	1,065.2788	167.3844	509.3799	388.5144	0.0	0.0
37. Government enterprise	13,100.0	337.4919	38.5174	99.3908	199.5791	0.0	0.0
38. Import	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39. Other	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40. Government compensation	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	1,035,008.4	26,650.9375	2,115.7134	10,842.7344	7,773.2852	4,858.9805	1,065.4866
Industry total	469,852.0	14,776.3672	1,133.3010	4,187.0391	4,674.1328	4,597.1328	189.9955
Transportation	39,460.0	3,360.6475	23.7983	2,740.4922	539.0232	57.3354	0.0
All others	525,696.4	8,513.92	958.6141	3,915.2031	2,560.1292	204.5123	875.4911

Table 10
1963 DIRECT AND TOTAL ENERGY INTENSITY FACTORS

Sector	Direct 10 ⁶ Btu/\$	Total 10 ⁶ Btu/\$
1. Agriculture	0.0220	0.0586
2. Mining	0.0527	0.0870
3. Construction	0.0100	0.0594
4. Ordnance	0.0049	0.0349
5. Food and kindred products	0.0105	0.0507
6. Fabrics and textiles	0.0104	0.0721
7. Apparel and fabricated textiles	0.0028	0.0430
8. Lumber and wood products	0.0091	0.0389
9. Furniture and fixtures	0.0061	0.0405
10. Paper and allied products	0.0705	0.1266
11. Printing and publishing	0.0035	0.0450
12. Chemical and allied products	0.0656	0.1324
13. Petroleum refining ^a	0.1172	0.1963
14. Rubber and plastic products	0.0140	0.0747
15. Leather and leather products	0.0027	0.0345
16. Glass, stone, and clay products	0.0758	0.1214
17. Primary iron and steel manufacturing	0.1391	0.2110
18. Primary nonferrous metals manufacturing	0.0402	0.0950
19. Fabricated metal products	0.0085	0.0809
20. Engines and turbines	0.0102	0.0616
21. Machinery except engines and turbines	0.0062	0.0545
22. Electrical equipment and supplies	0.0057	0.0419
23. Motor vehicles and equipment	0.0046	0.0624
24. Aircraft and parts	0.0043	0.0345
25. Other transportation equipment	0.0070	0.0662
26. Instruments and optical equipment	0.0061	0.0458
27. Air passenger transportation service	0.1302	0.1582
28. Air cargo transportation service	0.2903	0.3210
29. Vessel transportation service	0.1389	0.1609
30. Rail and motor transportation service	0.0478	0.0758
31. General transportation, warehousing	0.0852	0.1132
32. Communication	0.0091	0.0163
33. Utilities ^b	0.0445	0.0862
34. Wholesale, retail	0.0152	0.0284
35. Finance	0.0039	0.0173
36. General services	0.0078	0.0282
37. Government enterprise	0.0255	0.0429
38. Import	---	---

^a Delivered energy, 1.06×10^6 Btu/\$.

^b Delivered energy, 0.398×10^6 Btu/\$.

Special mention should be made about the energy intensities of the transportation sectors. After initial analysis using I/O tables, it was observed that the transportation sector used the most fuel--15 to 20 percent of total fuels and 30 to 40 percent of petroleum required for DoD expenditures. Considering this high usage and the fact that the DoD uses more air transport than generally used by industry and the country, a further breakdown of the energy intensity of each mode was obtained from Ref. 7; this information is shown in Table 11. Indirect energy usage remained unchanged. Air passenger and general transportation figures were taken directly from Ref. 9 (air transportation was

Table 11

ENERGY INTENSITY OF VARIOUS TRANSPORTATION MODES

Transportation Mode	Btu/ton-mi	\$/ton-mi	10 ⁶ Btu/\$
27. Air passenger			0.1302
28. Air cargo	63,000	0.217	0.2903
29. Vessel	500	0.0036	0.1389
30. Rail and motor			0.0478
Rail	750	0.013	0.0577
Truck	2,400	0.064	0.0375
31. General transportation			0.0904

SOURCE: References 6, 7, and 9.

considered essentially air passenger service). Rail and motor is an average figure taken from all three sources, and air cargo and vessel figures are from Ref. 6. We noted differences in total transportation expenditures between Refs. 2, 3, and 13; Refs. 2 and 3 showed substantially higher transportation expenditures than those given in Ref. 13. This difference was caused primarily by the fact that expenditures must be in producer prices for the interindustry matrix. The author of Refs. 2 and 3 had separated transportation from the expenditure and had shown this as part of the transportation cost independently, while the transportation expenditure shown in Ref. 13 is only those costs directly contracted out by DoD to common carriers. The difference was considered to be representative of general transportation and assigned

to sector 31. The end result of this analysis was to increase the importance of the transportation sector due to heavy reliance by DoD on air and vessel transportation.

An interesting point about energy intensity in Table 11 should be noticed. Although both air cargo and vessel transportation have high energy intensity per dollar expenditure, the amount of energy required per unit of work varies by a factor of 126. This points to some pitfalls if one is not careful in one's analysis.

So far, we have discussed energy required to produce one dollar of sales, or the first term in Eq. (9). The second term represents energy delivered per dollar of final demand. Matrix S is a 5×82 matrix defined in the appendices. Finally, we were able to evaluate the direct and total energy intensity factors, and the results were presented in Table 10.

Deflators

Finally, since all DoD expenditures are given in 1958 dollars and the I/O matrix is expressed in terms of energy per 1963 dollar, it is necessary to deflate the 1958 dollars to 1963 dollars. Table 12 shows the deflators, as given by Ref. 16.

Limitations

We must repeat that there are some severe limitations inherent in the methodology developed and used here. Some of these limitations are well known to researchers who have dealt extensively with the I/O technique, and some are particular to this study. The following are some of these limitations.

I/O Data. I/O data are subject to inaccuracies due to lack of complete coverage of an industry, restriction of information for proprietary reasons, and use of different time periods for different kinds of data.

Linear Assumptions. In the analysis, several linear assumptions were made. It is inherent in the I/O matrix that as one increases final demand in the sector all the inputs will increase proportionately. That is, if the demand for aircraft were doubled, would the usage of

Table 12

DEFLATORS TO CONVERT 1958 DOLLARS TO 1963 DOLLARS
FOR 40 INDUSTRIAL SECTORS

(1963 = 100)

Sector	1958 Deflators
1. Agriculture	110.9
2. Mining	99.0
3. Construction	97.5
4. Ordnance	94.0
5. Food and kindred products	99.2
6. Fabrics and textiles	98.5
7. Apparel and fabricated textiles	98.5
8. Lumber, wooden containers	98.8
9. Furniture	102.1
10. Paper and paper products	100.9
11. Printing	100.9
12. Chemicals, plastics, drugs, etc.	104.3
13. Petroleum refining and products	99.4
14. Rubber and miscellaneous plastic products	106.7
15. Leather, tanning, footwear	92.1
16. Glass, stone and clay products	98.6
17. Primary iron and steel manufacturing	100.8
18. Primary nonferrous manufacturing	96.4
19. Metal container, molding, stamp	99.0
20. Engines and turbines	97.9
21. Farm machinery and equipment	97.9
22. Communication and other electronic equipment	102.9
23. Motor vehicles and equipment	100.3
24. Aircraft and parts	94.0
25. Other transportation equipment	100.3
26. Professional scientific and optical instruments	102.7
27. Air passenger transportation	92.5
28. Air cargo transportation	92.5
29. Vessel transportation	92.5
30. Rail and motor transportation	92.5
31. General transportation	92.5
32. Communication excluding radio, TV	93.0
33. Electric, gas, water	93.0
34. Wholesale, retail	94.4
35. Finance	93.1
36. Services	92.6
37. Government enterprise	88.1
38. Import	100.0
39. Other	---
40. Government compensation	---
Total	

SOURCE: Reference 16, 1969 DoD procurement budget.

electricity double? Probably not; however, as long as no extreme changes in final demand are used, this assumption of a linear relationship is probably true.

What is of more concern is the linear assumption over time.* This includes the I/O matrix and the energy coefficient matrix. Changes in technology can affect both. It is almost impossible to estimate the change in the I/O matrix but it has been suggested that it is somewhat lower than the energy coefficient matrix. As we have said, the data needed to update the energy coefficient matrix were not available.

Problems of Interindustry Transfer. Problems of interindustry transfer are inherent in the way the I/O table is constructed. That is, the I/O sector definition is based on the establishment rather than the activities. For example, if those establishments that produce primary aluminum also produce aluminum castings (amounting to less than 50 percent of total sales), the primary aluminum sector is credited with their complete output, and the casting part of the industry is transferred and treated as a sale. The corresponding inputs are not, however, transferred.

Gross Time Delay in I/O Table Availability. There is generally a gross time delay between the availability of I/O Tables and the time period of current interest. For example, the latest available I/O Table is the 1963 table, the 1967 table is still not officially available. Therefore, any changes that have taken place in the intervening years due to changes in technology or the availability of productive inputs are not reflected in the coefficients.

Disaggregation Subject to Error. The disaggregation of DoD spending into the I/O sectors is subject to error. DoD spending is very heavy in certain industrial sectors, thus, those sectors require more disaggregation than the 82-sector table provides. On the other hand, there is very little DoD spending in other sectors, and these need

* At best, we can only estimate the error resulting from ignoring time dependence. In Ref. 9, Herendeen suggests that there is a 3 percent drop in overall energy intensity through 1966. Then the trend reverses, and energy intensity increases to 5.5 percent above the 1963 level for year 1970. In the computations, time dependence has been totally ignored.

aggregation. Both procedures can introduce errors in calculating the final energy demands.

DoD Versus U.S. Spending Patterns. DoD spending within a sector is not always representative of the U.S. economy as a whole. Notably, expenditures for military aircraft and communication equipment may differ significantly from U.S. patterns of spending for commercial aircraft and communication equipment.

These limitations are only some of the reservations regarding the methodology. Nevertheless, there are few alternatives available to estimate the total energy demand by industry for DoD support because of the complex manufacturing-sales chain in the U.S. economy.

III. RESULTS AND REMARKS

The amount of energy, by type, used by industries and services in support of DoD activities for the years 1965 and 1967 through 1970 were determined by the method outlined in Sec. II. Results for later years can be readily determined once defense expenditures are properly categorized, as they are in Refs. 2 and 3.

In computing the amount of energy used and, in particular, in attempting to compare the pattern of DoD energy consumption with the rest of the economy (of which DoD is a part), we exclude expenditures and energy consumed due to government compensation (sector 40), imports (sector 38), and others (sector 39). The exclusion of these sectors will make the comparison more meaningful in the sense that only those expenditures involving procurement within the United States are computed and compared. We repeat that, although there are many shortcomings and inaccuracies in the method developed, it is a commonly accepted methodology for the examination of such a complex problem. The results shown in Tables 13 through 16 are the U.S. energy consumption patterns as expressed in the 1963 40-sector tables. Table 13 shows a breakdown of the U.S. economy in dollars and percentages spent for final demand. Table 14 shows the total energy consumed to produce final demand for a given sector. This includes both the energy directly consumed by the sector and energy consumed by all other contributing sectors in producing the final demand of the given sector. Table 15 shows the amount of energy consumed by a sector only, i.e., the direct energy used by a particular sector for the final demand. The difference in energy consumed between Tables 14 and 15 for a given sector is the amount of energy used by all other sectors. Lastly, Table 16 shows the ultimate users of energy in the United States. That is, all energy as used by the sector for whatever purpose, either to support other sectors or to produce a final demand, is considered as energy consumed by the sector. This is the same as the energy flow shown in Table 9, although the reader should note that there is a slight difference between the results in Table 9 and Table 16. This is due to different methods of deriving the results. Table 9 was derived

Table 13

1963 U.S. EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	* 0 DOLLARS (MILLIONS)	* PERCENT	* 1963 DOLLARS (MILLIONS)	* PERCENT	* DEFLATOR 63=100.
1	AGRICULTURE	8907.00	1.63 *	8907.00	1.63 *	100.0
2	MINING	972.00	0.18 *	972.00	0.18 *	100.0
3	CONSTRUCTION	70443.00	12.91 *	70443.00	12.91 *	100.0
4	ORDNANCE	5654.00	1.04 *	5654.00	1.04 *	100.0
5	FOOD KINDRED & TOBACCO	58431.00	10.71 *	58431.00	10.71 *	100.0
6	FABRICS & TEXTILES	2187.00	0.40 *	2187.00	0.40 *	100.0
7	APPAREL & FABRICATED TEXTILES	15689.00	2.88 *	15689.00	2.88 *	100.0
8	LUMBER, WOODEN CONTAINERS	509.00	0.09 *	509.00	0.09 *	100.0
9	FURNITURE	4807.00	0.88 *	4807.00	0.88 *	100.0
10	PAPER & PAPER PRODUCTS	2071.00	0.38 *	2071.00	0.38 *	100.0
11	PRINTING	3999.00	0.73 *	3999.00	0.73 *	100.0
12	CHEMICALS, PLASTICS, DRUGS, ETC	9968.00	1.83 *	9968.00	1.83 *	100.0
13	PETROLEUM REFINING & PRODUCTS	10100.00	1.85 *	10100.00	1.85 *	100.0
14	RUBBER & MISC. PLASTIC PRODUCTS	2534.00	0.46 *	2534.00	0.46 *	100.0
15	LEATHER, TANNING, FOOTWEAR	3041.00	0.56 *	3041.00	0.56 *	100.0
16	GLASS, STONE & CLAY PRODUCTS	898.00	0.16 *	898.00	0.16 *	100.0
17	PRIMARY IRON & STEEL MANUF	653.00	0.12 *	653.00	0.12 *	100.0
18	PRIMARY NONFERROUS MANUF	636.00	0.12 *	636.00	0.12 *	100.0
19	METAL CONTAINERS, MCLDING, STAMP	2716.00	0.50 *	2716.00	0.50 *	100.0
20	ENGINES & TURBINES	1022.00	0.19 *	1022.00	0.19 *	100.0
21	FARM MACH & EQUIPMENT	17602.00	3.23 *	17602.00	3.23 *	100.0
22	COMMUNICATION & OTHER ELECT EQ	17656.00	3.24 *	17656.00	3.24 *	100.0
23	MOTOR VEHICLES & EQUIP	24357.00	4.46 *	24357.00	4.46 *	100.0
24	AIRCRAFT & PARTS	9226.00	1.69 *	9226.00	1.69 *	100.0
25	OTHER TRANSPORTATION EQUIPMENT	3811.00	0.70 *	3811.00	0.70 *	100.0
26	PRUF SCIENTIFIC & OPTICAL INSTR	7525.00	1.38 *	7525.00	1.38 *	100.0
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
28	AIR CAPGO TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
31	GENERAL TRANSPORTATION	14715.00	2.70 *	14715.00	2.70 *	100.0
32	COMMUNICATION EXC RADIO, TV	6799.00	1.25 *	6799.00	1.25 *	100.0
33	ELECTRIC, GAS, WATER	12513.00	2.29 *	12513.00	2.29 *	100.0
34	WHOLESALE, RETAIL	88551.00	16.23 *	88551.00	16.23 *	100.0
35	FINANCE	73362.00	13.45 *	73362.00	13.45 *	100.0
36	SERVICES	62115.00	11.38 *	62115.00	11.38 *	100.0
37	GOV'T ENTERPRISE	2134.00	0.39 *	2134.00	0.39 *	100.0
	TOTAL	545603.00	*	545603.00	*	100.0

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Table 14
TOTAL ENERGY USED IN 1963 TO PRODUCE U.S. FINAL DEMAND, BY SECTOR

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	8.91E 03	5.22E 02	2.97E 01	3.07E 02	1.21E 02	1.99	1.42	2.87	1.57
2	MINING	9.72E 02	8.46E 01	9.46E 00	1.75E 01	2.25E 01	0.32	0.45	0.16	0.29
3	CONSTRUCTION	7.04E 04	4.18E 03	2.66E 02	1.70E 03	1.14E 03	15.90	12.71	15.91	14.85
4	ORDNANCE	5.65E 03	1.98E 02	2.50E 01	5.09E 01	5.75E 01	0.75	1.20	0.48	0.75
5	FOOD KINDRED & TOBACCO	5.84E 04	2.96E 03	2.00E 02	1.27E 03	8.75E 02	11.28	9.60	11.91	11.40
6	FABRICS & TEXTILES	2.19E 03	1.58E 02	1.62E 01	5.56E 01	4.53E 01	0.60	0.78	0.52	0.59
7	APPAREL & FABRICATED TEXTILES	1.57E 04	6.75E 02	7.17E 01	2.51E 02	1.87E 02	2.57	3.43	2.34	2.44
8	LUMBER, WOODEN CONTAINERS	5.69E 02	1.98E 01	1.89E 00	8.82E 00	5.75E 00	0.08	0.09	0.08	0.07
9	FURNITURE	4.81E 03	2.38E 02	2.09E 01	7.41E 01	6.60E 01	0.91	1.00	0.69	0.86
10	PAPER & PAPER PRODUCTS	2.07E 03	2.62E 02	1.64E 01	6.70E 01	7.98E 01	0.00	0.79	0.63	1.04
11	PRINTING	4.00E 03	1.80E 02	1.55E 01	5.65E 01	5.64E 01	0.69	0.74	0.53	0.73
12	CHEMICALS, PLASTICS, DRUGS, ETC	9.97E 03	1.32E 03	1.13E 02	4.19E 02	4.58E 02	5.03	5.41	3.91	5.96
13	PETROLEUM REFINING & PRODUCTS	1.01E 04	1.98E 03	4.88E 01	1.01E 03	4.99E 02	7.54	2.34	9.45	6.49
14	RUBBER & MISC. PLASTIC PRODUCTS	2.53E 03	1.89E 02	1.82E 01	5.72E 01	5.69E 01	0.72	0.87	0.53	0.74
15	LEATHER, TANNING, FOOTWEAR	3.04E 03	1.05E 02	9.53E 00	3.86E 01	2.86E 01	0.40	0.46	0.36	0.37
16	GLASS, STONE & CLAY PRODUCTS	8.98E 02	1.09E 02	6.96E 00	1.95E 01	5.99E 01	0.41	0.33	0.18	0.78
17	PRIMARY IRON & STEEL MANUF	6.53E 02	1.38E 02	5.73E 00	2.06E 01	2.77E 01	0.52	0.27	0.19	0.36
18	PRIMARY NONFERROUS MANUF	6.36E 02	6.04E 01	1.27E 01	1.22E 01	2.73E 01	0.23	0.61	0.11	0.36
19	METAL CONTAINER, MOLDING, STAMP	2.72E 03	2.20E 02	1.76E 01	4.78E 01	5.94E 01	0.84	0.84	0.45	0.77
20	ENGINES & TURBINES	1.02E 03	6.28E 01	5.16E 00	1.45E 01	1.53E 01	0.24	0.25	0.14	0.20
21	FARM MACH & EQUIPMENT	1.76E 04	9.59E 02	7.75E 01	2.28E 02	2.52E 02	3.65	3.71	2.13	3.28
22	COMMUNICATION & OTHER ELECT EQ	1.77E 04	7.42E 02	7.86E 01	2.03E 02	2.36E 02	2.82	3.76	1.89	3.08
23	MOTOR VEHICLES & EQUIP	2.44E 04	1.52E 03	1.19E 02	3.47E 02	3.90E 02	5.78	5.68	3.24	5.08
24	AIRCRAFT & PARTS	9.23E 03	3.18E 02	4.05E 01	9.36E 01	9.01E 01	1.21	1.94	0.87	1.17
25	OTHER TRANSPORTATION EQUIPMENT	3.81E 03	2.52E 02	1.97E 01	5.63E 01	6.21E 01	0.96	0.94	0.53	0.81
26	PROF SCIENTIFIC & OPTICAL INSTR	7.53E 03	3.45E 02	3.28E 01	9.87E 01	1.01E 02	1.31	1.57	0.92	1.32
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	1.47E 04	1.67E 03	2.80E 01	1.24E 03	3.06E 02	6.34	1.34	11.60	3.99
32	COMMUNICATION EXC RADIO, TV	6.80E 03	1.11E 02	1.20E 01	5.87E 01	3.16E 01	0.42	0.57	0.55	0.41
33	ELECTRIC, GAS, WATER	1.25E 04	1.08E 03	1.87E 02	1.94E 02	5.59E 02	4.10	8.95	1.81	7.28
34	WHOLESALE, RETAIL	8.86E 04	2.51E 03	2.42E 02	1.33E 03	7.18E 02	9.55	11.57	12.39	9.35
35	FINANCE	7.34E 04	1.27E 03	1.24E 02	5.58E 02	4.19E 02	4.82	5.93	5.21	5.46
36	SERVICES	6.21E 04	1.75E 03	2.10E 02	7.55E 02	5.87E 02	6.67	10.06	7.06	7.64
37	GOV'T ENTERPRISE	2.13E 03	9.13E 01	8.33E 00	3.66E 01	3.86E 01	0.35	0.40	0.34	0.50
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	5.46E 05	2.63E 04	2.09E 03	1.07E 04	7.68E 03	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.05E 05	1.30E 04	9.74E 02	4.50E 03	3.74E 03	49.54	46.60	42.09	48.65
	TRANSPORTATION TOTAL	1.47E 04	1.67E 03	2.80E 01	1.24E 03	3.06E 02	6.34	1.34	11.60	3.99
	ALL OTHERS	3.26E 05	1.16E 04	1.09E 03	4.96E 03	3.64E 03	44.13	52.06	46.30	47.36

Table 15

DIRECT ENERGY USED BY SECTORS TO PRODUCE U.S. FINAL DEMAND IN 1963

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	8.91E 03	1.96E 02	7.26E 00	1.62E 02	2.50E 01	2.33	1.01	3.59	1.01
2	MINING	9.72E 02	5.12E 01	6.36E 00	7.85E 00	1.32E 01	0.61	0.89	3.17	0.53
3	CONSTRUCTION	7.04E 04	7.02E 02	2.28E 01	6.35E 02	4.44E 01	8.34	3.18	14.10	1.80
4	GRONANCE	5.65E 03	2.79E 01	6.73E 00	3.68E 00	7.51E 00	0.33	0.94	0.08	0.30
5	FOOD KINDRED & TOBACCO	5.84E 04	6.14E 02	4.83E 01	1.58E 02	2.39E 02	7.29	6.73	3.52	9.68
6	FABRICS & TEXTILES	2.19E 03	2.28E 01	4.37E 00	5.73E 00	5.47E 00	0.27	0.61	0.13	0.22
7	APPAREL & FABRICATED TEXTILES	1.57E 04	4.39E 01	7.78E 00	1.97E 01	9.21E 00	0.52	1.08	0.44	0.37
8	LUMBER, WOODEN CONTAINERS	5.09E 02	4.63E 00	7.34E-01	2.13E 00	1.42E 00	0.05	0.10	0.05	0.06
9	FURNITURE	4.81E 03	2.95E 01	4.85E 00	7.84E 00	7.11E 00	0.35	0.67	0.17	0.29
10	PAPER & PAPER PRODUCTS	2.07E 03	1.46E 02	8.07E 00	3.06E 01	4.36E 01	1.74	1.12	0.68	1.76
11	PRINTING	4.00E 03	1.38E 01	3.42E 00	5.78E 00	3.97E 00	0.16	0.43	0.13	0.16
12	CHEMICALS, PLASTICS, DRUGS, ETC	9.97E 03	6.54E 02	5.63E 01	2.20E 02	2.16E 02	7.77	7.84	4.89	8.74
13	PETROLEUM REFINING & PRODUCTS	1.01E 04	1.18E 03	1.79E 01	8.16E 02	3.43E 02	14.05	2.49	18.12	13.75
14	RUBBER & MISC. PLASTIC PRODUCTS	2.53E 03	3.53E 01	5.65E 00	7.79E 00	7.48E 00	0.42	0.79	0.17	0.30
15	LEATHER, TANNING, FOOTWEAR	3.04E 03	8.22E 00	1.66E 00	3.96E 00	9.30E-01	0.10	0.23	0.09	0.04
16	GLASS, STONE & CLAY PRODUCTS	8.98E 02	6.81E 01	3.73E 00	6.90E 00	4.44E 01	0.81	0.52	3.15	1.80
17	PRIMARY IRON & STEEL MANUF	6.53E 02	2.08E 01	2.91E 00	9.67E 00	1.65E 01	1.08	0.41	0.21	0.67
18	PRIMARY NONFERROUS MANUF	6.36E 02	2.56E 01	6.88E 00	3.42E 00	1.34E 01	0.30	0.96	0.08	0.54
19	METAL CONTAINER, MOLDING, STAMP	2.72E 03	2.30E 01	3.95E 00	7.24E 00	8.92E 00	0.27	0.55	0.16	0.36
20	ENGINES & TURBINES	1.02E 03	1.04E 01	1.20E 00	2.59E 00	1.65E 00	0.12	0.17	0.06	0.07
21	FARM MACH & EQUIPMENT	1.76E 04	1.09E 02	1.72E 01	3.07E 01	3.28E 01	1.30	2.40	0.68	1.33
22	COMMUNICATION & OTHER ELECT EQ	1.77E 04	1.01E 02	1.80E 01	2.73E 01	3.93E 01	1.20	2.51	0.61	1.58
23	MOTOR VEHICLES & EQUIP	2.44E 04	1.11E 02	1.98E 01	1.54E 01	2.71E 01	1.32	2.75	0.38	1.10
24	AIRCRAFT & PARTS	9.23E 03	3.92E 01	1.17E 01	1.54E 01	6.39E 00	0.47	1.62	0.34	0.26
25	OTHER TRANSPORTATION EQUIPMENT	3.81E 03	2.68E 01	4.33E 00	4.33E 00	5.40E 00	0.32	0.60	0.10	0.22
26	PROF SCIENTIFIC & OPTICAL INSTR	7.53E 03	4.61E 01	6.23E 00	1.08E 01	7.79E 00	0.55	0.87	0.24	0.32
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	1.47E 04	1.25E 03	9.03E 00	1.02E 03	2.01E 02	14.88	1.26	22.70	8.15
32	COMMUNICATION EXC RADIO, TV	6.80E 03	6.20E 01	8.11E 00	3.69E 01	1.73E 01	0.74	1.13	0.82	0.69
33	ELECTRIC, GAS, WATER	1.25E 04	5.57E 02	1.31E 02	5.29E 01	3.61E 02	6.61	18.19	1.17	14.62
34	WHOLESALE, RETAIL	8.86E 04	1.34E 03	1.49E 02	8.47E 02	3.47E 02	15.95	20.82	18.80	14.05
35	FINANCE	7.34E 04	2.83E 02	4.80E 01	1.01E 02	1.35E 02	3.36	6.68	2.23	5.44
36	SERVICES	6.21E 04	4.85E 02	6.87E 01	2.06E 02	2.10E 02	5.76	9.57	4.57	8.51
37	GOV'T ENTERPRISE	2.13E 03	5.43E 01	5.94E 00	1.63E 01	3.21E 01	0.65	0.83	0.36	1.30
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	5.46E 05	8.42E 03	7.18E 02	4.50E 03	2.47E 03	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.05E 05	3.44E 03	2.62E 02	1.42E 03	1.08E 03	40.79	36.45	31.47	43.90
	TRANSPORTATION TOTAL	1.47E 04	1.25E 03	9.03E 00	1.02E 03	2.01E 02	14.88	1.26	22.70	8.15
	ALL OTHERS	3.26E 05	3.73E 03	4.47E 02	2.06E 03	1.18E 03	44.33	62.30	45.83	47.95

Table 16

ENERGY CONSUMED IN 1963 BY ULTIMATE USER TO PRODUCE U.S. FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	5.71E 04	9.49E 02	4.61E 01	7.62E 02	1.17E 02	3.49	2.08	6.88	1.46
2	MINING	2.09E 04	1.49E 03	7.43E 01	1.29E 02	2.44E 02	5.50	3.35	1.16	3.06
3	CONSTRUCTION	8.63E 04	1.01E 03	3.01E 01	9.25E 02	5.84E 01	3.73	1.36	8.36	0.73
4	ORDNANCE	6.30E 03	3.11E 01	7.50E 00	4.11E 00	8.37E 00	0.11	0.34	0.04	0.10
5	FOOD KINDRED & TOBACCO	8.22E 04	8.65E 02	6.81E 01	2.23E 02	3.37E 02	3.19	3.07	2.02	4.22
6	FABRICS & TEXTILES	1.68E 04	2.18E 02	4.19E 01	5.84E 01	4.52E 01	0.80	1.89	0.53	0.57
7	APPAREL & FABRICATED TEXTILES	2.12E 04	5.89E 01	1.06E 01	2.59E 01	1.24E 01	0.22	0.48	0.23	0.16
8	LUMBER, WOODEN CONTAINERS	1.12E 04	1.00E 02	1.61E 01	4.57E 01	3.08E 01	0.37	0.72	0.41	0.39
9	FURNITURE	5.99E 03	3.68E 01	6.04E 00	9.77E 00	8.87E 00	0.14	0.27	0.09	0.11
10	PAPER & PAPER PRODUCTS	1.81E 04	1.06E 03	6.10E 01	2.24E 02	3.18E 02	3.92	2.75	2.03	3.99
11	PRINTING	1.69E 04	5.84E 01	1.44E 01	2.44E 01	1.68E 01	0.22	0.65	0.22	0.21
12	CHEMICALS, PLASTICS, DRUGS, ETC	3.57E 04	3.44E 03	3.23E 02	9.18E 02	1.25E 03	12.68	14.56	8.30	15.71
13	PETROLEUM REFINING & PRODUCTS	2.21E 04	2.59E 03	3.91E 01	1.78E 03	7.43E 02	9.53	1.76	16.13	9.30
14	RUBBER & MISC. PLASTIC PRODUCTS	9.87E 03	1.37E 02	2.20E 01	3.03E 01	2.91E 01	0.51	0.99	0.27	0.36
15	LEATHER, TANNING, FOOTWEAR	4.40E 03	3.08E 01	2.81E 00	1.21E 01	5.74E 00	0.11	0.13	0.11	0.07
16	GLASS, STONE & CLAY PRODUCTS	1.26E 04	1.00E 03	5.42E 01	1.08E 02	5.92E 02	3.68	2.44	0.97	7.41
17	PRIMARY IRON & STEEL MANUF	2.47E 04	3.44E 03	1.10E 02	3.66E 02	6.27E 02	12.66	4.97	3.31	7.85
18	PRIMARY NONFERROUS MANUF	1.44E 04	5.77E 02	1.55E 02	7.73E 01	3.02E 02	2.13	7.00	0.70	3.78
19	METAL CONTAINER, MOLDING, STAMP	2.55E 04	2.06E 02	3.62E 01	6.70E 01	7.79E 01	0.76	1.63	0.61	0.98
20	ENGINES & TURBINES	2.41E 03	2.46E 01	2.81E 00	6.10E 00	3.89E 00	0.09	0.13	0.06	0.05
21	FARM MACH & EQUIPMENT	3.26E 04	2.00E 02	3.37E 01	5.98E 01	6.03E 01	0.74	1.52	0.54	0.75
22	COMMUNICATION & OTHER ELECT EQ	4.01E 04	1.83E 02	3.25E 01	2.84E 01	4.46E 01	0.67	1.47	0.26	0.86
23	MOTOR VEHICLES & EQUIP	1.43E 04	6.08E 01	1.81E 01	2.39E 01	9.92E 00	0.22	0.82	0.22	0.12
24	AIRCRAFT & PARTS	4.90E 03	3.44E 01	5.56E 00	5.56E 00	6.94E 00	0.13	0.25	0.05	0.09
25	OTHER TRANSPORTATION EQUIPMENT	1.43E 04	8.60E 01	1.19E 01	2.08E 01	1.49E 01	0.32	0.53	0.19	0.19
26	PROF SCIENTIFIC & OPTICAL INSTR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	3.91E 04	3.33E 03	2.38E 01	2.72E 03	5.35E 02	12.28	1.07	24.57	6.70
32	COMMUNICATION EXC RADIO, TV	1.64E 04	1.39E 02	1.93E 01	7.96E 01	4.04E 01	0.51	0.87	0.72	0.51
33	ELECTRIC, GAS, WATER	3.09E 04	1.38E 03	3.23E 02	1.31E 02	8.93E 02	5.07	14.55	1.18	11.18
34	WHOLESALE, RETAIL	1.22E 05	1.84E 03	2.05E 02	1.16E 03	4.76E 02	6.79	9.24	10.50	5.96
35	FINANCE	1.21E 05	5.03E 02	8.64E 01	1.80E 02	2.37E 02	1.85	3.89	1.62	2.97
36	SERVICES	1.36E 05	1.52E 03	2.61E 02	7.01E 02	5.61E 02	5.61	11.75	6.33	7.03
37	GOV'T ENTERPRISE	1.36E 04	3.48E 02	3.98E 01	1.03E 02	2.06E 02	1.28	1.79	0.93	2.58
38	IMPORT	1.67E 04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	1.03E 04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	1.14E 06	2.72E 04	2.22E 03	1.11E 04	7.99E 03	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	4.70E 05	1.46E 04	1.11E 03	4.18E 03	4.62E 03	53.89	50.04	37.75	57.82
	TRANSPORTATION TOTAL	3.91E 04	3.33E 03	2.38E 01	2.72E 03	5.35E 02	12.28	1.07	24.56	6.70
	ALL OTHERS	6.31E 05	9.19E 03	1.08E 03	4.17E 03	2.83E 03	33.84	48.88	37.69	35.48

primarily from the *Census of Manufacturers*, while Table 16 used the I/O matrix as described in the previous section. The differences are primarily due to matrix inversion.

Energy consumed by industries for the year 1970 in support of DoD activities is shown in Tables 17 through 20. Details of DoD activities for the years 1965 and 1967 through 1969 are provided in Appendix B.

Some interesting observations can be made from the results shown in Tables 17 through 20. (Similar observations for other years can be made from the tables in Appendix B.) As noted earlier, the single largest DoD expenditure is for government compensation. It is typically about 35 percent of the total DoD budget. In our analysis we do not include government compensation because it involves no energy consumption. Our analysis deals only with the energy consumed in supplying the goods and services purchased from outside sources to support DoD activities.

Figure 3 shows the DoD energy usage pattern. Although some variations are noted from year to year, which are functions of expenditures only, by and large the ranking of the energy consumption for the five years examined remain fairly constant. Transportation, aircraft and parts, communication and other electronic equipment, petroleum, and ordnance are the five largest energy-consuming sectors. It is somewhat surprising that transportation is the largest since the transportation cost is only about five percent of the DoD budget. Further examination of data showed, however, that transportation is highly energy-intensive and, in addition, DoD spends a fairly large proportion of its transportation budget on the most energy-intensive modes of transportation, such as air passenger and air freight.

Figure 4 shows the energy consumption patterns of the DoD in 1970 and the United States in 1963. Although this figure deals with two different time periods (which illustrates one of the difficulties mentioned earlier), it nevertheless illustrates the relative industrial dependence on energy of the two economies.

Figure 4 shows that over 73 percent of the industrial energy consumption for DoD's needs are concentrated in six industries, while the top six consumers for the United States as a whole consumed only 57 percent. Furthermore, of the six largest users in each of the two economies,

Table 17

1970 DEPARTMENT OF DEFENSE EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	1958 DOLLARS (MILLIONS)	PERCENT *	1963 DOLLARS (MILLIONS)	PERCENT	DEFLATOR 63=100.
1	AGRICULTURE	173.30	0.54 *	156.27	0.47	110.9
2	MINING	29.70	0.09 *	30.01	0.09	99.0
3	CONSTRUCTION	1130.40	3.53 *	1159.38	3.50	97.5
4	ORDNANCE	5144.60	16.05 *	5472.97	16.22	94.0
5	FOOD KINORED & TOBACCO	897.00	2.80 *	904.23	2.73	99.2
6	FABRICS & TEXTILES	135.00	0.42 *	137.06	0.41	98.5
7	APPAREL & FABRICATED TEXTILES	211.70	0.66 *	214.92	0.65	98.5
8	LUMBER, WOODEN CONTAINERS	17.00	0.05 *	17.21	0.05	98.8
9	FURNITURE	24.10	0.08 *	23.60	0.07	102.1
10	PAPER & PAPER PRODUCTS	39.00	0.12 *	38.05	0.12	100.9
11	PRINTING	176.50	0.56 *	176.91	0.53	100.9
12	CHEMICALS, PLASTICS, DRUGS, ETC	542.00	1.69 *	519.82	1.57	104.3
13	PETROLEUM REFINING & PRODUCTS	1181.00	3.69 *	1188.13	3.59	99.4
14	RUBBER & MISC. PLASTIC PRODUCTS	143.00	0.45 *	134.02	0.40	106.7
15	LEATHER, TANNING, FOOTWEAR	53.30	0.17 *	57.67	0.17	92.1
16	GLASS, STONE & CLAY PRODUCTS	22.80	0.07 *	23.12	0.07	98.6
17	PRIMARY IRON & STEEL MANUF	53.20	0.17 *	52.78	0.16	100.8
18	PRIMARY NONFERROUS MANUF	63.10	0.20 *	65.46	0.20	96.4
19	METAL CONTAINER, MOLDING, STAMP	192.60	0.60 *	194.55	0.59	99.0
20	ENGINES & TURBINES	172.60	0.54 *	176.51	0.53	97.9
21	FARM MACH & EQUIPMENT	819.60	2.56 *	837.18	2.53	97.9
22	COMMUNICATION & OTHER ELECT EQ	5574.00	17.39 *	5416.90	16.35	102.9
23	MOTOR VEHICLES & EQUIP	623.00	1.94 *	621.14	1.87	100.3
24	AIRCRAFT & PARTS	6831.00	21.32 *	7267.02	21.93	94.0
25	OTHER TRANSPORTATION EQUIPMENT	1073.00	3.35 *	1069.79	3.23	100.3
26	PROF SCIENTIFIC & OPTICAL INSTR	655.00	2.04 *	638.05	1.93	102.7
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0 *	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0 *	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	2510.20	7.83 *	2713.73	8.19	92.5
32	COMMUNICATION EXC RADIO, TV	350.00	1.09 *	376.34	1.14	93.0
33	ELECTRIC, GAS, WATER	239.70	0.75 *	257.74	0.78	93.0
34	WHOLESALE, RETAIL	829.00	2.59 *	878.18	2.65	94.4
35	FINANCE	86.10	0.27 *	92.48	0.28	93.1
36	SERVICES	1975.80	6.17 *	2135.82	6.45	92.5
37	GOV'T ENTERPRISE	76.70	0.24 *	87.08	0.26	88.1
38	IMPORT	0.0	0.0 *	0.0	0.0	0.0
39	OTHER	0.0	0.0 *	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0 *	0.0	0.0	0.0
	TOTAL	32047.13	100.0 *	33134.82	100.0	96.7

Table 18
TOTAL ENERGY USED IN 1970 TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND, BY SECTOR

SEC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.56E 02	8.21E 00	5.26E-01	4.90E 00	1.96E 00	0.45	0.37	0.59	0.42
2	MINING	3.00E 01	2.47E 00	2.67E-01	4.85E-01	2.52E-01	0.13	0.19	0.06	0.05
3	CONSTRUCTION	1.16E 03	6.00E 01	3.91E 00	3.19E 01	5.57E 01	3.50	2.76	3.83	3.40
4	ORDNANCE	5.47E 03	1.91E 02	2.42E 01	4.93E 01	1.44E 01	10.23	17.10	5.93	11.04
5	FOOD KINDRED & TOBACCO	9.04E 02	4.83E 01	3.27E 00	2.07E 01	1.44E 01	2.58	2.31	2.49	3.00
6	FABRICS & TEXTILES	1.37E 02	1.04E 01	1.12E 00	3.67E 00	2.51E 00	0.56	0.79	0.43	0.02
7	APPAREL & FABRICATED TEXTILES	2.15E 02	9.62E 00	1.02E 00	3.54E 00	2.68E 00	0.51	0.72	0.44	0.57
8	LUMBER, WOODEN CONTAINERS	1.72E 01	7.49E-01	6.80E-02	2.91E-01	2.04E-01	0.04	0.05	0.04	0.04
9	FURNITURE	2.36E 01	1.24E 00	1.04E-01	3.51E-01	3.52E-01	0.07	0.07	0.04	0.07
10	PAPER & PAPER PRODUCTS	3.87E 01	4.12E 00	2.71E-01	1.10E 00	1.26E 00	0.22	0.19	0.13	0.27
11	PRINTING	1.77E 02	7.97E 00	6.86E-01	2.50E 00	2.45E 00	0.43	0.48	0.30	0.53
12	CHEMICALS, PLASTICS, DRUGS, ETC	5.20E 02	1.11E 02	1.07E 01	2.68E 01	4.34E 01	5.92	7.54	3.22	3.22
13	PETROLEUM REFINING & PRODUCTS	1.19E 03	2.33E 02	5.74E 00	1.19E 02	5.67E 01	12.47	4.05	14.30	12.47
14	RUBBER & MISC. PLASTIC PRODUCTS	1.34E 02	1.00E 01	9.65E-01	3.03E 00	3.01E 00	0.53	0.68	0.36	0.04
15	LEATHER, TANNING, FOOTWEAR	5.79E 01	2.00E 00	1.81E-01	7.32E-01	5.43E-01	0.11	0.13	0.09	0.12
16	GLASS, STONE & CLAY PRODUCTS	2.31E 01	2.86E 00	1.81E-01	5.22E-01	1.53E 00	0.15	0.13	0.00	0.32
17	PRIMARY IRON & STEEL MANUF	5.28E 01	1.11E 01	4.63E-01	1.06E 00	2.24E 00	0.60	0.33	0.20	0.48
18	PRIMARY NONFERROUS MANUF	6.55E 01	6.22E 00	1.31E 00	1.25E 00	2.81E 00	0.33	0.52	0.15	0.60
19	METAL CONTAINER, MULDING, STAMP	1.55E 02	1.63E 01	1.27E 00	3.48E 00	4.25E 00	0.87	0.90	0.42	0.91
20	ENGINES & TURBINES	1.77E 02	1.08E 01	8.92E-01	2.50E 00	2.04E 00	0.58	0.63	0.30	0.56
21	FARM MACH & EQUIPMENT	8.37E 02	3.97E 01	3.43E 00	9.88E 00	1.05E 01	2.12	2.42	1.19	2.44
22	COMMUNICATION & OTHER ELECT EQ	5.42E 03	1.84E 02	2.04E 01	5.54E 01	6.07E 01	9.81	14.40	6.66	12.90
23	MOTOR VEHICLES & EQUIP	6.21E 02	3.87E 01	3.02E 00	8.84E 00	9.94E 00	2.07	2.14	1.06	2.14
24	AIRCRAFT & PARTS	7.27E 03	2.51E 02	3.19E 01	7.38E 01	7.10E 01	13.40	22.53	8.87	15.09
25	OTHER TRANSPORTATION EQUIPMENT	1.07E 03	7.08E 01	5.53E 00	1.58E 01	1.74E 01	3.79	3.90	1.90	3.70
26	PRGF SCIENTIFIC & OPTICAL INSTR	6.38E 02	2.82E 01	2.73E 00	8.21E 00	8.62E 00	1.51	1.93	0.99	1.63
27	AIR PASSENGER TRANSPORTATION	4.06E 02	6.42E 01	6.09E-01	5.91E 01	3.57E 00	3.42	1.00	7.10	0.76
28	AIR CARGO TRANSPORTATION	1.33E 02	4.26E 01	1.99E-01	4.05E 01	1.17E 00	2.28	0.14	4.87	0.25
29	VESSEL TRANSPORTATION	9.93E 02	1.60E 02	1.69E 00	1.42E 02	7.95E 00	8.56	1.19	17.07	1.69
30	RAIL AND MOTOR TRANSPORTATION	4.48E 01	3.40E 00	8.52E-02	2.64E 00	3.86E-01	0.18	0.06	0.32	0.08
31	GENERAL TRANSPORTATION	1.14E 03	1.28E 02	2.16E 00	9.59E 01	2.36E 01	6.84	1.52	11.53	5.01
32	COMMUNICATION EXC RADIC, TV	3.70E 02	9.12E 00	6.61E-01	3.26E 00	1.75E 00	0.33	0.47	0.39	0.37
33	ELECTRIC, GAS, WATER	2.58E 02	2.22E 01	3.85E 00	4.00E 00	1.15E 01	1.19	2.72	0.48	2.49
34	WHOLESALE, RETAIL	8.70E 02	2.49E 01	2.40E 00	1.31E 01	7.12E 00	1.33	1.09	1.58	1.51
35	FINANCE	9.25E 01	1.50E 00	1.48E-01	6.97E-01	5.10E-01	0.08	0.10	0.08	0.11
36	SEVICES	1.70E 03	4.79E 01	5.44E 00	2.02E 01	1.62E 01	2.50	3.84	2.42	3.42
37	GOV'T ENTERPRISE	8.71E 01	2.70E 00	2.10E-01	1.20E 00	9.86E-01	0.14	0.15	0.15	0.21
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.27E 04	1.87E 03	1.42E 02	8.32E 02	4.71E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.52E 04	1.29E 03	1.19E 02	4.12E 02	3.77E 02	68.90	84.35	49.56	60.19
	TRANSPORTATION TOTAL	2.71E 03	3.99E 02	4.75E 00	3.40E 02	3.60E 01	21.31	3.35	40.85	1.79
	ALL OTHERS	4.74E 03	1.83E 02	1.74E 01	7.98E 01	5.66E 01	9.79	12.30	9.59	12.02



Table 19

DIRECT ENERGY USED BY SECTORS TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND IN 1970

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.56E 02	2.32E 00	1.27E-01	1.84E 00	2.81E-01	0.31	0.28	0.38	0.19
2	MINING	3.00E 01	1.46E 00	1.77E-01	2.10E-01	2.55E-02	0.20	0.39	0.04	0.02
3	CONSTRUCTION	1.16E 03	1.65E 01	4.44E-01	1.52E 01	8.62E-01	2.24	0.98	3.15	0.59
4	URONANCE	5.47E 03	2.70E 01	6.51E 00	3.57E 00	7.27E 00	3.57	14.41	0.74	5.02
5	FUCD KINDRED & TOBACCO	5.04E 02	1.03E 01	8.06E-01	2.67E 00	4.06E 00	1.40	1.78	0.55	2.80
6	FABRICS & TEXTILES	1.37E 02	1.81E 00	3.48E-01	4.88E-01	3.71E-01	0.25	0.77	0.10	0.29
7	APPAREL & FABRICATED TEXTILES	2.15E 02	5.86E-01	1.08E-01	2.49E-01	1.25E-01	0.08	0.24	0.05	0.09
8	LUMBER, WOODEN CONTAINERS	1.72E 01	1.15E-01	2.44E-02	4.37E-02	3.87E-02	0.02	0.05	0.01	0.03
9	FURNITURE	2.36E 01	1.48E-01	2.42E-02	2.94E-02	4.64E-02	0.02	0.05	0.01	0.03
10	PAPER & PAPER PRODUCTS	3.87E 01	1.73E 00	1.06E-01	3.71E-01	2.23E-01	0.23	0.24	0.08	0.30
11	PRINTING	1.77E 02	6.13E-01	1.51E-01	2.56E-01	1.76E-01	0.08	0.33	0.05	0.12
12	CHEMICALS, PLASTICS, DRUGS, ETC	5.20E 02	6.92E 01	7.21E 00	1.43E 01	4.00E 01	9.39	15.94	2.97	19.38
13	PETROLEUM REFINING & PRODUCTS	1.19E 03	1.39E 02	2.10E 00	9.60E 01	3.56E-01	18.90	4.65	19.88	27.50
14	RUBBER & MISC. PLASTIC PRODUCTS	1.34E 02	1.87E 00	2.59E-01	4.12E-01	3.56E-01	0.25	0.56	0.09	0.27
15	LEATHER, TANNING, FOOTWEAR	5.79E 01	1.50E-01	3.14E-02	7.31E-02	1.62E-02	0.02	0.07	0.02	0.01
16	GLASS, STONE & CLAY PRODUCTS	2.31E 01	1.79E 00	9.76E-02	1.85E-01	1.12E 00	0.24	0.22	0.04	0.77
17	PRIMARY IRON & STEEL MANUF	5.28E 01	7.34E 00	2.36E-01	7.82E-01	1.34E 00	1.00	0.52	0.16	0.52
18	PRIMARY NONFERROUS MANUF	6.55E 01	2.63E 00	7.08E-01	3.52E-01	1.38E 00	0.36	1.57	0.07	0.59
19	METAL CONTAINER, MULDING, STAMP	1.95E 02	1.53E 00	2.88E-01	4.83E-01	5.80E-01	0.21	0.64	0.10	0.40
20	ENGINES & TURBINES	1.77E 02	1.80E 00	2.07E-01	4.47E-01	2.85E-01	0.24	0.46	0.09	0.20
21	FARM MACH & EQUIPMENT	8.37E 02	4.35E 00	7.92E-01	1.38E 00	1.21E 00	0.59	1.75	0.28	0.83
22	COMMUNICATION & OTHER ELECT EQ	9.42E 03	3.02E 01	4.86E 00	9.88E 00	1.15E 01	4.10	10.75	2.05	8.16
23	MOTOR VEHICLES & EQUIP	2.21E 02	2.83E 00	5.04E-01	4.40E-01	6.52E-01	0.38	1.11	0.09	0.48
24	AIRCRAFT & PARTS	7.27E 03	3.09E 01	9.19E 00	1.21E 01	5.03E 00	4.19	20.32	2.51	3.47
25	OTHER TRANSPORTATION EQUIPMENT	1.07E 03	7.51E 00	1.21E 00	1.21E 00	1.52E 00	1.02	2.69	0.25	1.05
26	PROF SCIENTIFIC & OPTICAL INSTR	6.38E 02	4.53E 00	9.12E-01	1.61E 00	7.43E-01	0.61	1.13	0.33	0.51
27	AIR PASSENGER TRANSPORTATION	4.06E 02	5.29E 01	9.74E-02	5.21E 01	6.86E-01	7.18	0.21	10.79	0.47
28	AIR CARGO TRANSPORTATION	1.33E 02	3.89E 01	3.19E-02	3.86E 01	2.24E-01	5.28	0.07	8.00	0.15
29	VESSEL TRANSPORTATION	9.93E 02	1.32E 02	3.58E-01	1.27E 02	8.94E-01	17.91	0.79	26.29	0.62
30	RAIL AND MOTOR TRANSPORTATION	4.48E 01	2.14E 00	1.61E-02	1.98E 00	6.72E-02	0.29	0.04	0.41	0.05
31	GENERAL TRANSPORTATION	1.14E 03	9.68E 01	6.82E-01	7.89E 01	1.55E 01	13.13	1.51	16.34	10.69
32	COMMUNICATION EXC RADIO, TV	3.76E 02	3.44E 00	4.49E-01	2.05E 00	9.42E-01	0.47	0.99	0.42	0.65
33	ELECTRIC, GAS, WATER	2.58E 02	1.15E 01	2.69E 00	1.09E 00	7.44E 00	1.56	5.95	0.23	5.13
34	WHOLESALE, RETAIL	8.78E 02	1.33E 01	1.48E 00	8.40E 00	3.44E 00	1.81	3.28	1.74	2.38
35	FINANCE	9.25E 01	3.29E-01	5.48E-02	1.16E-01	1.58E-01	0.04	0.12	0.02	0.11
36	SERVICES	1.70E 03	1.39E 01	1.86E 00	6.30E 00	5.78E 00	1.89	4.11	1.30	3.99
37	GOV'T ENTERPRISE	8.71E 01	3.13E 00	3.42E-01	5.39E-01	1.85E 00	0.43	0.76	0.19	1.28
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.27E 04	7.37E 02	4.52E 01	4.83E 02	1.45E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.52E 04	3.48E 02	3.63E 01	1.47E 02	1.07E 02	47.26	80.35	30.53	73.71
	TRANSPORTATION TOTAL	2.71E 03	3.23E 02	1.26E 00	2.99E 02	1.73E 01	43.79	2.78	61.98	11.95
	ALL OTHERS	4.74E 03	6.59E 01	7.63E 00	3.62E 01	2.68E 01	8.95	16.87	7.49	14.34

Table 20

ENERGY CONSUMED IN 1970 BY ULTIMATE USER TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.16E 03	1.80E 01	9.26E-01	1.43E 01	2.20E 00	0.95	0.04	1.71	0.40
2	MINING	1.49E 03	2.07E 02	5.21E 00	1.68E 01	1.35E 00	5.68	3.02	0.94	3.22
3	CONSTRUCTION	1.72E 03	2.75E 01	6.99E-01	2.54E 01	1.35E 00	1.46	0.49	3.03	0.26
4	ORDNANCE	5.85E 03	2.89E 01	6.96E 00	3.81E 00	7.76E 00	1.53	4.83	0.45	1.03
5	FOOD KINDRED & TOBACCO	1.51E 03	1.70E 01	1.34E 00	4.42E 00	6.72E 00	0.90	0.93	0.53	1.41
6	FABRICS & TEXTILES	5.65E 02	7.33E 00	1.41E 00	1.96E 00	1.53E 00	0.39	0.98	0.23	0.32
7	APPAREL & FABRICATED TEXTILES	3.59E 02	9.73E-01	1.81E-01	4.06E-01	2.09E-01	0.05	0.13	0.05	0.04
8	LUMBER, WOODEN CONTAINERS	3.87E 02	3.39E 00	5.57E-01	1.53E 00	1.05E 00	0.18	0.39	0.18	0.22
9	FURNITURE	1.76E 02	1.08E 00	1.77E-01	2.88E-01	2.59E-01	0.06	0.12	0.03	0.03
10	PAPER & PAPER PRODUCTS	7.76E 02	4.42E 01	2.55E 00	5.34E 00	1.32E 01	2.34	1.78	1.11	2.70
11	PRINTING	8.41E 02	2.91E 00	7.20E-01	1.22E 00	8.36E-01	0.15	0.50	0.15	0.10
12	CHEMICALS, PLASTICS, DRUGS, ETC	1.92E 03	2.50E 02	2.28E 01	5.31E 01	8.87E 01	12.18	15.81	6.33	16.03
13	PETROLEUM REFINING & PRODUCTS	1.88E 03	2.20E 02	3.32E 00	1.52E 02	6.31E 01	11.00	2.31	18.08	13.25
14	RUBBER & MISC. PLASTIC PRODUCTS	6.52E 02	9.63E 00	1.54E 00	2.13E 00	2.04E 00	0.51	1.07	0.25	0.43
15	LEATHER, TANNING, FOOTWEAR	9.59E 01	7.14E-01	6.21E-02	2.79E-01	1.35E-01	0.04	0.04	0.03	0.03
16	GLASS, STONE & CLAY PRODUCTS	4.34E 02	3.37E 01	1.84E 00	3.51E 00	2.10E 01	1.79	1.28	0.42	4.41
17	PRIMARY IRON & STEEL MANUF	2.03E 03	2.82E 02	9.07E 00	3.01E 01	5.15E 01	14.97	6.30	3.59	10.81
18	METAL CONTAINER, MULDING, STAMP	1.70E 03	1.45E 01	2.38E 00	4.77E 00	5.55E 00	0.77	1.06	0.57	9.30
19	ENGINES & TURBINES	3.21E 02	3.28E 00	3.75E-01	8.13E-01	5.18E-01	0.17	0.26	0.10	0.11
20	FARM MACH & EQUIPMENT	2.75E 03	1.58E 01	3.10E 00	5.36E 00	4.68E 00	0.84	2.15	0.04	0.98
21	COMMUNICATION & OTHER ELECT EQ	8.97E 03	5.07E 01	9.20E 00	1.71E 01	1.45E 01	2.09	6.40	2.04	3.00
22	MOTOR VEHICLES & EQUIP	1.17E 03	5.32E 00	9.47E-01	8.27E-01	1.30E 00	0.28	0.65	0.10	0.27
23	AIRCRAFT & PARTS	1.09E 04	4.62E 01	1.38E 01	1.82E 01	7.53E 00	2.45	9.58	2.17	1.58
24	OTHER TRANSPORTATION EQUIPMENT	1.25E 03	8.70E 00	1.42E 00	1.42E 00	1.77E 00	0.46	0.98	0.17	0.37
25	PROF SCIENTIFIC & OPTICAL INSTR	1.30E 03	8.17E 00	1.66E 00	2.71E 00	1.47E 00	0.43	0.74	0.32	0.31
26	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	GENERAL TRANSPORTATION	4.20E 03	4.49E 02	2.15E 00	4.02E 02	3.76E 01	23.80	1.50	47.98	7.09
31	COMMUNICATION EXC RADIO, TV	9.77E 02	8.35E 00	1.16E 00	4.78E 00	2.42E 00	0.44	0.80	0.57	0.51
32	ELECTRIC, GAS, WATER	1.15E 03	5.10E 01	1.20E 01	4.85E 00	3.31E 01	2.70	6.32	0.58	6.95
33	WHOLESALE, RETAIL	2.68E 03	4.06E 01	4.52E 00	2.56E 01	1.05E 01	2.15	3.14	3.05	2.20
34	FINANCE	1.89E 03	8.30E 00	1.45E 00	2.99E 00	3.52E 00	0.44	1.01	0.36	0.82
35	SERVICES	4.38E 03	4.28E 01	6.74E 00	2.00E 01	1.61E 01	2.27	4.68	2.38	3.38
36	GOV'T ENTERPRISE	5.81E 02	1.44E 01	1.85E 00	4.22E 00	6.45E 00	0.76	1.14	0.50	1.70
37	IMPORT	1.22E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	OTHER	6.82E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	TOTAL	7.01E 04	1.89E 03	1.44E 02	8.38E 02	4.76E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	4.80E 04	1.12E 03	1.07E 02	3.26E 02	3.44E 02	59.34	74.66	38.09	72.10
	TRANSPORTATION TOTAL	4.20E 03	4.49E 02	2.15E 00	4.02E 02	3.76E 01	23.80	1.50	47.98	7.09
	ALL OTHERS	1.79E 04	3.18E 02	3.43E 01	1.10E 02	9.48E 01	16.06	23.04	13.13	19.93



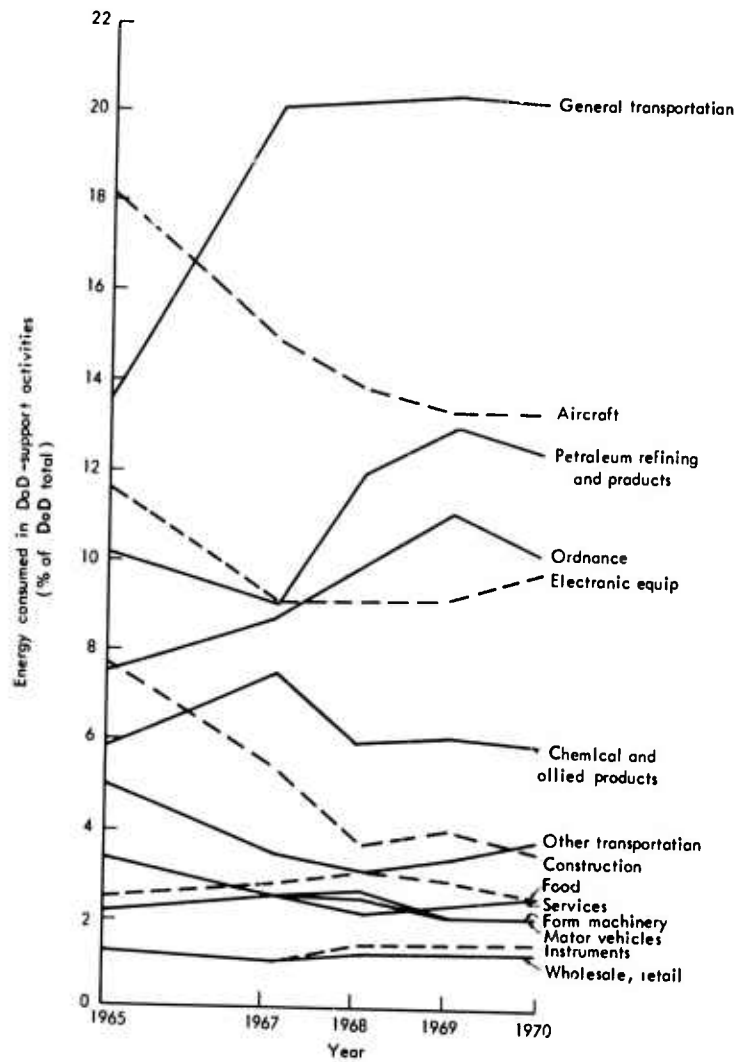


Fig. 3 — Percentage of energy consumed by the top 14 industrial energy consumers in DoD-support activities, 1965-1970

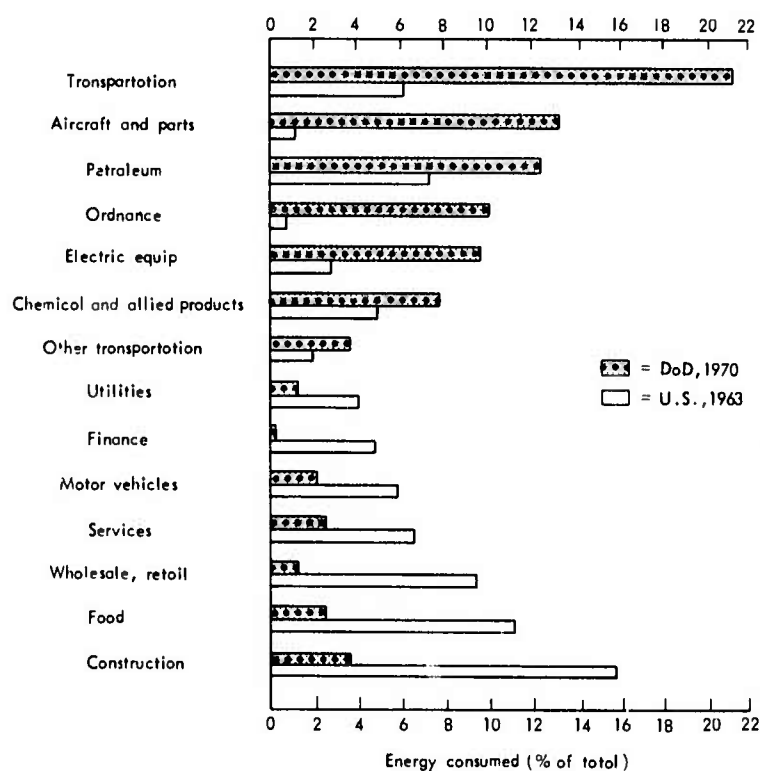


Fig. 4 — Energy consumption patterns of the DoD in 1970 and the United States in 1963, by industrial sector

only two are common to both--transportation and petroleum refining and products. Transportation is the largest user for DoD, which reflects the large amount of goods and personnel movement, while the U.S. economy as a whole uses only 6.3 percent. The service-oriented nature of the civilian economy is also reflected by the amount of energy used in whole-sale, retail, and service industries, while DoD is the more industrially oriented, as typified by the energy consumed by the aircraft and parts, ordnance, and electrical equipment industries.

Another interesting comparison between the DoD and U.S. consumption is energy intensity. Table 21 shows the direct and total energy intensities for DoD and the U.S. expenditures. It is particularly interesting to note that except for transportation, the direct energy intensity for DoD is a factor of two or more lower than the U.S. economy as a whole. This is due to the fact that most of the producers under DoD contracts are not energy-intensive industries, e.g., gas utilities, electric utilities, primary iron, etc. They are mostly manufacturers of highly complex and high-cost finished goods. On the other hand, the total manufacturing energy intensity is about the same as for the United States;

Table 21
COMPARISON OF ENERGY INTENSITY OF UNITED STATES AND DOD
(In 10^6 Btu/\$ final demand)

Year	Energy Intensity							
	All Sectors		Manufacturing		Transportation		All Others	
	Direct	Total	Direct	Total	Direct	Total	Direct	Total
1965 DoD	0.0173 ^a	0.0518 ^a	0.0120	0.0486	0.1188 ^a	0.1468 ^a	0.0133	0.0413
1967 DoD	0.0215 ^a	0.0568 ^a	0.0133	0.0589	0.1188 ^a	0.1468 ^a	0.0132	0.0408
1968 DoD	0.0224 ^a	0.0577 ^a	0.0137	0.0513	0.1188 ^a	0.1468 ^a	0.0137	0.0391
1969 DoD	0.0197	0.0575	0.0140	0.0514	0.1187	0.1467	0.0139	0.0399
1970 DoD	0.0225	0.0572	0.0138	0.0512	0.1189	0.1469	0.0139	0.0384
U.S. economy ^b	0.0258	0.0482	0.0315	0.0634	0.0852	0.1132	0.0212	0.0356

^aEnergy intensity for transportation sector based on the years 1969 and 1970.

^b1963 data only.

that is because the manufacturers draw on the same set of industries to supply all their material and interindustry needs. When we view energy intensity as a whole, we note that the total is slightly higher for the DoD than for the United States. This is due primarily to the DoD's expenditures on transportation services. Table 22 shows that portion of the DoD budget concomitant with energy calculations presented herein, and Fig. 5 shows that the percentage of energy consumption is always slightly higher than the percentage of expenditures. For the years examined, we note that from 4 to 7 percent of U.S. energy consumed is in support of DoD's purchases of goods and services. In fact, the total energy consumed by the industries in supplying DoD's needs is

Table 22
COMPARISON OF DOD AND U.S. EXPENDITURES
AND ENERGY CONSUMPTION

Year	United States ^a		DoD Procurement of Goods	
	1963 \$ ^b (billions)	Energy ^c (10 ¹² Btu)	1963 \$ ^d (billions)	Energy (10 ¹² Btu)
1963	545.6	26,300	---	---
1965	597.5	28,800	24.38	1,230
1967	649.7	31,300	35.84	2,000
1968	678.9	32,700	40.83	2,323
1969	697.3	33,600	38.38	2,180
1970	690.9	33,300	33.13	1,870

NOTE: The energy consumed as given in this table is different from the total energy consumed by the United States as given in Ref. 16. This is due to the fact that this table gives only the energy used by industry and energy used by the utilities to produce energy. Not included in the table is energy used by the private consumer or the government.

^aThe year 1963 is from Ref. 14, and the years 1965-1970 are from Ref. 16.

^bTotal U.S. production by private industry (GNP minus government compensation).

^cEnergy intensity is equal to 0.0482×10^{12} Btu/\$ GNP (in 1963 dollars).

^dDefense expenditures minus imports and government compensation.

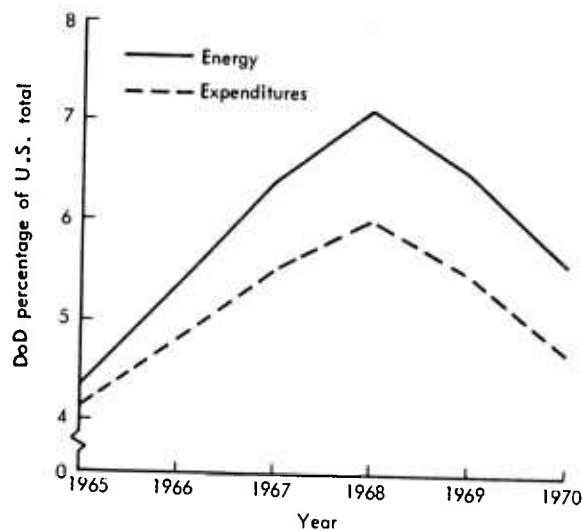


Fig. 5 — Expenditure and energy usage by DoD in private industry

almost identical to the amount of energy consumed directly by DoD in the actual operation of all the military systems. For example, for FY 71 it is estimated that worldwide DoD energy consumption was 2460 trillion Btu's, while, according to our calculations, the industries used about 1870 trillion Btu's to produce all the goods and services for DoD.

We have presented a method for estimating the energy consumed by industries in support of DoD activities. Although the method has its shortcomings, it is about the only way one can analyze the complex chain of manufacturing and sales. One obvious improvement that can be made is to bring the I/O table up to date when data become available. Work is currently going on elsewhere to this end, and we intend to update our results when these data become available. Meanwhile, this model can be used as a tool not only to analyze past energy use, but also to estimate future energy consumption due to DoD expenditures on goods and services.

Appendix A

ENERGY BALANCE

To ensure that the energy coefficient matrix \underline{R} is consistent with actual production of energy, we will check to see if energy consumed equals energy produced. In our equation, discussed in the text under I/O Table,

$$\underline{E} = [\underline{R}(\underline{I} - \underline{A})^{-1} + \underline{S}]\underline{Y} ,$$

where energy consumed is defined in terms of the form in which it is used--electricity, petroleum, coal, gas, and crude oil. On the other hand, energy production is defined in terms of the primary energy sources--coal, crude, hydroelectric, and nuclear. Some method must be devised to allocate secondary energy back to the primary energy source. In other words, petroleum and natural gas are produced from the primary energy source--crude oil. Electricity is produced from a combination of all the primary energy sources. We used the data in Table 23 to compute primary energy production.*

Also, in the main text we ignored matrix \underline{S} , average energy delivered to final demand per dollar expenditure. Only the energy sectors of matrix \underline{S} have nonzero terms. For each dollar expenditure for coal, crude, petroleum, or utilities, however, there is associated an amount of energy delivered to the final demand in addition to the energy required to produce \$1 of product. For instance, when a motorist buys \$1 of gasoline, he is buying energy. Converted to 1963 producer prices, this amounts to 0.125×10^6 Btu/gal divided by 12¢/gal to get 1.04×10^6 Btu/\$ sale. Table 24 was used to convert \$1 of final demand to average energy delivered to final demand.†

* For a further description, see Ref. 9.

† See Ref. 9 for further information.

Table 23

PRIMARY ENERGY PRODUCTION

Energy Consumed (1 Btu)	Primary Energy Production (Btu)		
	Coal	Crude	All Others ^a
Coal	1	0	0
Crude	0	1	0
Petroleum	0	0.896 ^b	0
Electricity	1.754	0.843	0.184 (0.586) ^c
Gas	0	0.970 ^b	0

^aHydroelectric, nuclear.

^bCrude production is less due to imports.

^c18.4 percent produced was hydroelectric or nuclear. To convert to equivalent fossil fuel requirements, 18.4 percent was multiplied by 3.1826, which was derived as follows: $(1.754 + 0.843)/(1 - 0.184)$.

Table 24

ENERGY DELIVERED TO FINAL DEMAND PER DOLLAR OF FINAL DEMAND
(10⁶ Btu)

Final Demand	Average Energy Delivered			
	Coal	Petroleum	Electricity	Gas
\$1 coal	4.094	0	0	0
\$1 petroleum	0	1.060	(b)	(b)
\$1 utilities	0	0	0.08103 ^a	0.3166 ^a

^aElectricity was based on 0.1435×10^6 Btu/\$ sale, and gas was 0.9925×10^6 Btu/\$ sale. These were prorated to the utilities sector on a proportional rate of 52 and 38 percent.

^bWhile it is known that electricity and gas are used to refine petroleum, the exact amount is unknown.

Finally, to compute total energy consumption, two equations were used; they were:

$$\underline{E} = \underline{R}\underline{X} + \underline{S}\underline{Y} , \quad (\text{method 1}),$$

and

$$\underline{E} = \underline{R}(\underline{I} - \underline{A})^{-1} \underline{Y} + \underline{S}\underline{Y} \quad (\text{method 2}).$$

Although these equations are mathematically equivalent, in practice, due to some inaccuracies in taking the inverse of an 82×82 matrix, both methods were used for the energy balance. The results were presented in the main text.

Appendix B

DEFENSE PROCUREMENT AND ENERGY REQUIREMENTS

TABLES FOR YEARS 1965 AND 1967-1969

For each year, 1965 and 1967 through 1969, there are four tables. The first table of each set gives the expenditures in both 1958 and 1963 dollars and the percentages of each expenditure of total DoD expenditures. This enables one to assess the relative importance of each sector in the DoD expenditures. The remaining three tables in each set show the amounts and types of energy used by the industries expressed both in terms of final demand and end users.

Table 25

1965 DEPARTMENT OF DEFENSE EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	* 1958 DOLLARS (MILLIONS)	PERCENT *	1963 DOLLARS (MILLIONS)	PERCENT *	DEFLATOR 63=100.
1	AGRICULTURE	130.50	0.55 *	117.67	0.48 *	110.9
2	MINING	28.80	0.12 *	29.10	0.12 *	99.0
3	CONSTRUCTION	1595.00	6.76 *	1635.90	6.72 *	97.5
4	URANCE	2463.50	10.45 *	2620.74	10.77 *	94.0
5	FOOD KINDRED & TOEACCO	565.60	2.40 *	570.16	2.34 *	99.2
6	FABRICS & TEXTILES	101.30	0.43 *	102.84	0.42 *	98.5
7	APPAREL & FABRICATED TEXTILES	133.70	0.57 *	135.74	0.56 *	98.5
8	LUMBER, WOODEN CONTAINERS	7.60	0.03 *	7.69	0.03 *	98.8
9	FURNITURE	29.20	0.12 *	28.60	0.12 *	102.1
10	PAPER & PAPER PRODUCTS	30.00	0.13 *	29.73	0.12 *	100.9
11	PRINTING	139.00	0.59 *	137.76	0.57 *	100.9
12	CHEMICALS, PLASTICS, DRUGS, ETC	353.90	1.50 *	339.01	1.39 *	104.4
13	PETROLEUM REFINING & PRODUCTS	627.30	2.66 *	631.09	2.59 *	99.4
14	RUBBER & MISC. PLASTIC PRODUCTS	113.90	0.48 *	106.75	0.44 *	106.7
15	LEATHER, TANNING, FOOTWEAR	29.40	0.12 *	31.92	0.13 *	92.1
16	GLASS, STONE & CLAY PRODUCTS	13.80	0.06 *	14.00	0.06 *	98.6
17	PRIMARY IRON & STEEL MANUF	37.60	0.16 *	37.30	0.15 *	100.8
18	PRIMARY NONFERRULS MANUF	57.50	0.24 *	59.65	0.25 *	96.4
19	METAL CONTAINER, CLOTHING, STAMP	83.30	0.35 *	84.14	0.35 *	99.0
20	ENGINES & TURBINES	121.80	0.52 *	124.41	0.51 *	97.9
21	FARM MACH & EQUIPMENT	586.60	2.49 *	599.18	2.46 *	97.9
22	COMMUNICATION & OTHER ELECT EQ	4318.80	18.31 *	4197.08	17.25 *	102.9
23	MOTOR VEHICLES & EQUIP	514.00	2.18 *	512.46	2.11 *	100.3
24	AIRCRAFT & PARTS	6102.30	25.88 *	6491.80	26.68 *	94.0
25	OTHER TRANSPORTATION EQUIPMENT	528.00	3.94 *	925.22	3.80 *	100.3
26	PROF SCIENTIFIC & OPTICAL INSTR	404.80	1.72 *	394.36	1.62 *	102.6
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
30	RAIL AND MOTOR TRANSPORTATION	1035.00	4.39 *	1118.92	4.60 *	92.5
31	GENERAL TRANSPORTATION	249.00	1.06 *	267.74	1.10 *	93.0
32	COMMUNICATION EXC RADIO, TV	148.50	0.63 *	159.68	0.66 *	93.0
33	ELECTRIC, GAS, WATER	525.00	2.23 *	556.14	2.29 *	94.4
34	WHOLESALE, RETAIL	82.70	0.35 *	88.83	0.37 *	93.1
35	FINANCE	1571.30	8.36 *	2119.25	8.71 *	93.0
36	SERVICES	53.60	0.23 *	60.96	0.25 *	87.9
37	GOV'T ENTERPRISE	0.0	0.0 *	0.0	0.0 *	0.0
38	IMPORT	0.0	0.0 *	0.0	0.0 *	0.0
39	OTHER	0.0	0.0 *	0.0	0.0 *	0.0
40	GOV'T COMPENSATION	0.0	0.0 *	0.0	0.0 *	0.0
	TOTAL	23582.21	100.0 *	24335.72	100.0 *	96.9

Table 26

TOTAL ENERGY USED IN 1965 TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND, BY SECTOR

SEC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.18E 02	6.59E 00	3.89E 00	3.82E 00	1.52E 00	0.54	0.38	0.77	0.46
2	MINING	2.91E 01	2.40E 00	2.59E 01	4.70E 01	2.44E 01	0.19	0.25	0.09	0.37
3	CONSTRUCTION	1.64E 03	9.41E 01	5.54E 00	4.47E 01	2.31E 01	7.65	5.38	9.02	7.04
4	ORDNANCE	2.62E 03	5.16E 01	1.16E 01	2.36E 01	2.67E 01	7.45	11.27	4.76	8.13
5	FOOD KINDRED & TOBACCO	5.70E 02	3.04E 01	2.06E 00	1.30E 01	9.05E 00	2.47	2.00	2.63	2.76
6	FABRICS & TEXTILES	1.03E 02	7.60E 00	7.95E 01	2.68E 00	2.15E 00	0.62	0.77	0.54	0.66
7	APPAREL & FABRICATED TEXTILES	1.36	6.24E 00	6.66E 01	2.29E 00	1.74E 00	0.51	0.65	0.46	0.53
8	LUMBER, WOODEN CONTAINERS	7.6E 01	3.31E 01	3.02E 02	1.31E 01	9.08E 02	0.03	0.03	0.03	0.03
9	FURNITURE	2.86	1.49E 00	1.26E 01	4.28E 01	2.1E 01	0.12	0.12	0.09	0.13
10	PAPER & PAPER PRODUCTS	2.97E 02	3.53E 00	2.25E 01	9.16E 01	1.08E 00	0.29	0.22	0.18	0.33
11	PRINTING	1.38E 02	6.20E 00	5.34E 01	1.95E 00	1.94E 00	0.50	0.52	0.39	0.59
12	CHEMICALS, PLASTICS, DRUGS, ETC	3.39E 02	7.19E 01	6.89E 00	1.75E 01	2.80E 01	5.84	6.69	3.52	8.53
13	PETROLEUM REFINING & PRODUCTS	6.31E 02	1.24E 02	3.05E 00	6.32E 01	3.12E 01	10.07	2.96	12.74	9.50
14	RUBBER & MISC. PLASTIC PRODUCTS	1.07E 02	7.97E 00	7.68E 01	2.41E 00	2.40E 00	0.65	0.75	0.49	0.73
15	LEATHER, TANNING, FOOTWEAR	3.19E 01	1.10E 00	1.00E 01	4.04E 01	2.99E 01	0.09	0.10	0.08	0.09
16	GLASS, STONE & CLAY PRODUCTS	1.40E 01	1.67E 00	1.08E 01	2.96E 01	9.41E 01	0.14	0.10	0.06	0.29
17	PRIMARY IRON & STEEL MANUF	3.73E 01	7.87E 00	3.27E 01	1.18E 00	1.58E 00	0.64	0.32	0.24	0.48
18	PRIMARY NONFERROUS MANUF	5.96E 01	5.66E 00	1.19E 00	1.14E 00	2.57E 00	0.46	1.16	0.23	0.78
19	METAL CONTAINER, MCLDING, STAMP	8.41E 01	7.11E 00	5.48E 01	1.52E 00	1.85E 00	0.58	0.53	0.31	0.57
20	ENGINES & TURBINES	1.24E 02	7.65E 00	6.28E 01	1.77E 00	1.86E 00	0.62	0.61	0.36	0.57
21	FARM MACH & EQUIPMENT	5.99E 02	2.55E 01	2.27E 00	6.60E 00	6.83E 00	2.07	2.21	1.33	2.08
22	COMMUNICATION & OTHER ELECT EQ	4.20E 03	1.43E 02	1.59E 01	4.29E 01	4.71E 01	11.60	15.41	8.66	14.38
23	MOTOR VEHICLES & EQUIP	5.12E 02	3.20E 01	2.49E 00	7.29E 00	8.20E 00	2.60	2.42	1.47	2.50
24	AIRCRAFT & PARTS	6.49E 03	2.24E 02	2.85E 01	6.59E 01	6.34E 01	18.21	27.69	13.28	19.34
25	OTHER TRANSPORTATION EQUIPMENT	9.25E 02	6.13E 01	4.78E 00	1.37E 01	1.51E 01	4.98	4.64	2.76	4.60
26	PROF SCIENTIFIC & OPTICAL INSTR	3.94E 02	1.64E 01	1.67E 00	4.74E 00	5.03E 00	1.33	1.62	0.96	1.53
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	1.12E 03	1.64E 02	1.97E 00	1.40E 02	1.54E 01	13.36	1.91	28.13	4.71
32	COMMUNICATION EXC RADIO, TV	2.68E 02	4.36E 03	4.71E 01	2.32E 00	1.24E 00	0.35	0.46	0.47	0.38
33	ELECTRIC, GAS, WATER	1.60E 02	1.38E 01	2.39E 00	2.48E 00	7.13E 00	1.12	2.32	0.50	2.18
34	WHOLESALE, RETAIL	5.56E 02	1.58E 01	1.52E 00	8.33E 00	4.51E 00	1.28	1.48	1.68	1.37
35	FINANCE	8.88E 01	1.47E 00	1.35E 01	6.64E 01	4.75E 01	0.12	0.13	0.13	0.14
36	SERVICES	1.48E 03	4.14E 01	4.90E 00	1.73E 01	1.41E 01	3.37	4.76	3.48	4.30
37	GOV'T ENTERPRISE	6.10E 01	1.80E 00	1.41E 01	8.62E 01	6.41E 01	0.15	0.14	0.17	0.20
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	2.37E 04	1.23E 03	1.03E 02	4.96E 02	3.28E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	1.82E 04	8.84E 02	8.52E 01	2.76E 02	2.59E 02	71.87	82.79	55.55	79.14
	TRANSPORTATION TOTAL	1.12E 03	1.64E 02	1.97E 00	1.40E 02	1.54E 01	13.36	1.91	28.13	4.71
	ALL OTHERS	4.40E 03	1.82E 02	1.57E 01	8.09E 01	5.30E 01	14.77	15.29	16.32	16.16

Table 27

DIRECT ENERGY USED BY SECTORS TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND IN 1965

STC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.18E 02	2.07E 00	8.90E-02	1.69E 00	2.54E-01	0.51	0.28	0.68	0.28
2	MINING	2.91E 01	1.42E 00	1.72E-01	2.03E-01	2.40E-02	0.35	0.54	0.08	0.33
3	CONSTRUCTION	1.64E 03	2.30E 01	6.23E-01	2.12E 01	1.20E 00	0.52	1.96	8.58	1.35
4	CRONANCE	2.62E 03	1.29E 01	3.12E 00	1.71E 00	3.48E 00	3.16	9.81	0.69	3.89
5	FOOD KINORED & TCRACCO	5.70E 02	6.48E 00	5.07E-01	1.68E 03	2.56E 00	1.58	1.60	0.68	2.36
6	FABRICS & TEXTILFS	1.03E 02	1.20E 00	2.30E-01	3.12E-01	2.67E-02	0.29	0.72	0.13	0.30
7	APPAREL & FABRICATED TEXTILES	1.36E 02	3.63E-01	6.87E-02	1.48E-01	7.88E-02	0.09	0.22	0.06	0.39
8	LUMBER, WOODEN CONTAINERS	7.69E 00	5.33E-02	1.09E-02	2.08E-02	1.77E-02	0.01	0.03	0.01	0.02
9	FURNITURE	2.86E 01	1.79E-01	2.92E-02	3.75E-02	5.39E-02	0.04	0.09	0.02	0.06
10	PAPER & PAPER PRODUCTS	2.97E 01	1.81E 00	1.03E-01	3.80E-01	5.40E-01	0.44	0.32	0.15	0.50
11	PRINTING	1.38E 02	4.77E-01	1.8E-01	1.99E-01	1.37E-01	0.12	0.37	0.08	0.15
12	CHEMICALS, PLASTICS, DRUGS, ETC	3.39E 02	4.44E 01	4.57E 00	9.36E 00	1.78E 01	10.82	14.39	3.78	19.95
13	PETROLEUM REFINING & PRODUCTS	6.31E 02	7.40E 01	1.12E 01	5.10E 01	2.12E 01	18.04	3.51	20.62	23.74
14	RUBBER & MISC. PLASTIC PRODUCTS	1.07E 02	1.49E 00	2.38E-01	3.28E-01	3.15E-01	0.36	0.75	0.13	0.35
15	LEATHER, TANNING, FOOTWEAR	3.19E 01	8.12E-02	1.73E-02	3.98E-02	8.57E-03	0.02	0.05	0.02	0.01
16	GLASS, STONE & CLAY PRODUCTS	1.40E 01	1.05E 00	5.77E-02	1.04E-01	7.00E-01	0.26	0.18	0.04	0.78
17	PRIMARY IRON & STEEL MANUF	3.73E 01	5.19E 00	1.67E-01	5.52E-01	9.45E-01	1.27	0.52	0.22	1.06
18	PRIMARY NONFERROUS MANUF	5.56E 01	2.40E 00	6.45E-01	3.21E-01	1.26E 00	0.59	2.03	0.13	1.41
19	METAL CONTAINER, MOLDING, STAMP	8.41E 01	6.51E-01	1.23E-01	2.08E-01	2.44E-01	0.16	0.39	0.08	0.27
20	ENGINES & TURBINES	1.24E 02	1.27E 00	1.46E-01	3.15E-01	2.01E-01	0.31	0.46	0.13	0.22
21	FARM MACH & EQUIPMENT	5.99E 02	2.89E 00	5.26E-01	9.69E-01	7.52E-01	0.70	1.65	0.39	0.84
22	COMMUNICATION & OTHER ELECT EQ	4.20E 03	2.34E 01	3.78E 00	7.61E 00	9.16E 00	5.70	11.90	3.08	10.25
23	MOTOR VEHICLES & EQUIP	5.12E 02	2.34E 00	4.16E-01	3.63E-01	5.71E-01	0.57	1.31	0.15	0.54
24	AIRCRAFT & PARTS	6.49E 03	2.76E 01	8.21E 00	1.08E 01	4.49E 00	6.73	25.81	4.39	5.03
25	OTHER TRANSPORTATION EQUIPMENT	9.25E 02	6.50E 00	1.05E 00	1.05E 00	1.31E 00	1.58	3.30	0.42	1.47
26	PROF SCIENTIFIC & OPTICAL INSTR	3.94E 02	2.05E 00	3.25E-01	6.99E-01	4.39E-01	0.50	1.02	0.28	0.49
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	1.12E 03	1.33E 02	5.30E-01	1.23E 02	7.47E 00	32.42	1.67	49.69	8.36
32	COMMUNICATION EXC RADIO, TV	2.68E 02	2.45E 00	3.20E-01	1.46E 00	6.70E-01	0.60	1.01	0.59	0.75
33	ELECTRIC, GAS, WATER	1.60E 02	7.11E 00	1.67E 00	6.75E-01	4.61E 00	1.73	5.24	0.27	5.16
34	WHOLESALE, RETAIL	5.56E 02	8.44E 00	9.39E-01	5.32E 00	2.18E 00	2.06	2.95	2.15	2.44
35	FINANCE	8.88E 01	2.93E-01	4.81E-02	1.03E-01	1.42E-01	0.07	0.15	0.04	0.16
36	SERVICES	1.48E 03	1.13E 01	1.58E 00	4.82E 00	4.90E 00	2.76	4.96	1.95	5.49
37	GOV'T ENTERPRISE	6.10E 01	2.27E 00	2.48E-01	6.80E-01	1.34E 00	0.55	0.78	0.27	1.50
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	2.37E 04	4.10E 02	3.18E 01	2.47E 02	8.94E 01	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	1.82E 04	2.19E 02	2.56E 01	8.82E 01	6.66E 01	53.34	80.46	35.69	74.49
	TRANSPORTATION TOTAL	1.12E 03	1.33E 02	5.30E-01	1.23E 02	7.47E 00	32.42	1.67	49.69	8.36
	ALL OTHERS	4.40E 03	5.84E 01	5.68E 00	3.62E 01	1.53E 01	14.24	17.88	14.62	17.15

Table 28

ENERGY CONSUMED IN 1965 BY ULTIMATE USER TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	7.98E 02	1.26E 01	6.24E-01	1.01E 01	1.54E 00	1.01	0.59	2.01	0.46
2	MINING	9.80E 02	6.82E 01	3.73E 00	5.68E 00	1.12E 01	5.47	3.54	1.13	3.36
3	CONSTRUCTION	2.01E 03	3.04E 01	7.94E-01	2.81E 01	1.54E 00	2.44	0.75	5.58	0.46
4	URONANCE	2.87E 03	1.42E 01	3.42E 00	1.87E 00	3.81E 00	1.14	3.24	0.37	1.14
5	FOOD KINDRED & TOBACCO	9.91E 02	1.11E 01	8.73E-01	2.89E 00	4.39E 00	0.89	0.83	0.27	1.32
6	FABRICS & TEXTILES	4.15E 02	5.15E 00	9.89E-01	1.36E 00	1.10E 00	0.41	0.94	0.27	0.33
7	APPAREL & FABRICATED TEXTILES	2.38E 02	6.36E-01	1.21E-01	2.57E-01	1.38E-01	0.05	0.11	0.05	0.34
8	LUMBER, WOODEN CONTAINERS	3.32E 02	2.94E 00	4.78E-01	1.33E 00	9.08E-01	0.24	0.45	0.27	0.27
9	FURNITURE	1.50E 02	9.23E-01	1.52E-01	7.00E 00	2.26E-01	0.07	0.14	0.05	0.07
10	PAPER & PAPER PRODUCTS	5.72E 02	3.32E 01	1.91E 00	7.00E 00	9.93E 00	2.66	1.81	1.39	2.98
11	PRINTING	6.46E 02	2.24E 00	5.53E-01	9.35E-01	6.42E-01	0.18	0.52	0.19	0.19
12	CHEMICALS, PLASTICS, DRUGS, ETC	1.29E 03	1.61E 02	1.58E 01	3.80E 01	6.15E 01	12.90	14.97	7.56	18.42
13	PETROLEUM REFINING & PRODUCTS	1.09E 03	1.28E 02	1.94E 00	8.84E 01	3.68E 01	10.28	1.84	17.57	11.02
14	RUBBER & MISC. PLASTIC PRODUCTS	5.09E 02	7.09E 00	1.14E 00	1.57E 00	1.50E 00	0.57	1.08	0.31	0.45
15	LEATHER, TANNING, FOOTWEAR	5.65E 01	4.35E-01	3.69E-02	1.69E-01	8.30E-02	0.03	0.04	0.03	0.02
16	GLASS, STONE & CLAY PRODUCTS	3.73E 02	2.92E 01	1.59E 00	3.07E 00	1.79E 01	2.34	1.51	0.61	5.36
17	PRIMARY IRON & STEEL MANUF	1.53E 03	2.13E 02	6.85E 00	2.27E 01	3.89E 01	17.12	6.50	4.52	11.55
18	PRIMARY NONFERROUS MANUF	1.59E 03	6.40E 01	1.72E 01	8.56E 00	3.35E 01	5.13	16.33	1.70	10.04
19	METAL CONTAINER, MCLDING, STAMP	1.29E 03	1.10E 01	1.80E 00	3.59E 00	4.20E 00	0.88	1.71	0.71	1.26
20	ENGINES & TURBINES	2.35E 02	2.40E 00	2.74E-01	5.94E-01	3.79E-01	0.19	0.26	0.12	0.11
21	FARM MACH & EQUIPMENT	2.10E 03	1.18E 01	2.33E 00	4.08E 00	3.46E 00	0.95	2.21	0.81	1.04
22	COMMUNICATION & OTHER ELECT EQ	6.83E 03	3.86E 01	7.01E 00	1.29E 01	1.41E 01	3.09	6.65	2.57	4.21
23	MOTOR VEHICLES & EQUIP	9.43E 02	4.30E 00	7.65E-01	6.68E-01	1.05E 00	0.35	0.73	0.13	0.31
24	AIRCRAFT & PARTS	8.86E 03	3.76E 01	1.12E 00	1.48E 01	6.14E 00	3.02	10.63	2.94	1.84
25	OTHER TRANSPORTATION EQUIPMENT	1.06E 03	7.44E 00	1.20E 00	1.20E 00	1.50E 00	0.60	1.14	0.24	0.45
26	PROF SCIENTIFIC & OPTICAL INSTR	8.89E 02	4.64E 00	7.34E-01	1.47E 00	9.73E-01	0.37	0.70	0.29	0.29
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	2.15E 03	2.21E 02	1.15E 00	1.94E 02	2.15E 01	17.70	1.09	38.65	6.46
32	COMMUNICATION EXC RADIO, TV	7.10E 02	6.04E 00	8.40E-01	3.45E 00	1.75E 00	0.48	0.80	0.69	0.53
33	ELECTRIC, GAS, WATER	8.08E 02	3.60E 01	8.44E 00	3.42E 00	2.33E 01	2.89	8.01	0.68	6.99
34	WHOLESALE, RETAIL	1.93E 03	2.92E 01	3.25E 00	1.84E 01	7.55E 00	2.34	3.08	3.66	2.26
35	FINANCE	1.38E 03	6.03E 00	1.04E 00	2.16E 00	2.83E 00	0.48	0.99	0.43	0.85
36	SERVICES	3.64E 03	3.70E 01	6.11E 00	1.69E 01	1.40E 01	2.96	5.80	3.35	4.19
37	GOV'T ENTERPRISE	3.97E 02	9.28E 00	1.07E 00	2.72E 00	5.49E 00	0.74	1.02	0.54	1.54
38	IMPORT	8.44E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	5.11E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	5.11E 04	1.25E 03	1.05E 02	5.03E 02	3.34E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	3.50E 04	7.91E 02	7.83E 01	2.16E 02	2.43E 02	63.47	74.33	43.28	72.81
	TRANSPORTATION TOTAL	2.15E 03	2.21E 02	1.15E 00	1.94E 02	2.15E 01	17.70	1.09	38.65	6.46
	ALL OTHERS	1.40E 04	2.35E 02	2.59E 01	9.09E 01	6.92E 01	18.83	24.58	18.07	20.74

Table 29

1967 DEPARTMENT OF DEFENSE EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	* 1958 DOLLARS (MILLIONS)	PERCENT *	1963 DOLLARS (MILLIONS)	PERCENT *	DEFLATOR 63=100 *
1	AGRICULTURE	154.00	0.44 *	138.86	0.38 *	110.9
2	MINING	27.70	0.08 *	27.99	0.08 *	98.9
3	CONSTRUCTION	1846.00	5.33 *	1893.33	5.28 *	97.5
4	IRON AND STEEL	4714.00	13.60 *	5014.89	13.99 *	94.0
5	FOOD KINDRED & TOBACCO	1048.10	3.02 *	1056.55	2.95 *	99.2
6	FABRICS & TEXTILES	299.10	0.86 *	303.65	0.85 *	98.5
7	APPAREL & FABRICATED TEXTILES	430.80	1.24 *	437.36	1.22 *	98.5
8	LUMBER, WOODEN CONTAINERS	47.40	0.14 *	47.98	0.13 *	98.8
9	FURNITURE	49.00	0.14 *	47.99	0.13 *	102.1
10	PAPER & PAPER PRODUCTS	68.00	0.20 *	67.39	0.19 *	100.9
11	PRINTING	137.80	0.40 *	136.57	0.38 *	100.9
12	CHEMICALS, PLASTICS, DRUGS, ETC	736.80	2.13 *	706.27	1.97 *	104.3
13	PETROLEUM REFINING & PRODUCTS	508.90	2.62 *	914.39	2.55 *	99.4
14	RUBBER & MISC. PLASTIC PRODUCTS	183.60	0.53 *	172.07	0.48 *	106.7
15	LEATHER, TANNING, FOOTWEAR	98.00	0.28 *	106.41	0.30 *	92.1
16	GLASS, STONE & CLAY PRODUCTS	23.90	0.07 *	24.24	0.07 *	98.6
17	PRIMARY IRON & STEEL MANUF	101.80	0.29 *	100.99	0.28 *	100.8
18	PRIMARY NONFERROUS MANUF	120.70	0.35 *	125.21	0.35 *	96.4
19	METAL CONTAINER, MCLDING, STAMP	203.20	0.59 *	205.25	0.57 *	99.0
20	ENGINES & TURBINES	218.80	0.63 *	223.49	0.62 *	97.9
21	FARM MACH & EQUIPMENT	1021.80	2.95 *	1043.72	2.91 *	97.9
22	COMMUNICATION & OTHER ELECT EQ	5390.89	15.55 *	5238.96	14.62 *	102.9
23	MOTOR VEHICLES & EQUIP	517.30	2.65 *	914.56	2.55 *	100.3
24	AIRCRAFT & PARTS	8113.50	23.41 *	8631.38	24.08 *	94.0
25	OTHER TRANSPORTATION EQUIPMENT	1049.30	3.03 *	1046.16	2.92 *	100.3
26	PROF SCIENTIFIC & OPTICAL INSTR	535.30	1.54 *	521.83	1.46 *	102.6
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
31	GENERAL TRANSPORTATION	2542.40	7.34 *	2748.54	7.67 *	92.5
32	COMMUNICATION EXC RADIO, TV	310.20	0.90 *	333.55	0.93 *	93.0
33	ELECTRIC, GAS, WATER	176.80	0.51 *	190.11	0.53 *	93.0
34	WHOLESALE, RETAIL	721.20	2.08 *	763.98	2.13 *	94.4
35	FINANCE	87.00	0.25 *	93.45	0.26 *	93.1
36	SERVICES	2310.10	6.67 *	2490.44	6.95 *	92.8
37	GOV'T ENTERPRISE	64.40	0.19 *	73.04	0.20 *	88.2
38	IMPORT	0.0	0.0 *	0.0	0.0 *	0.0
39	OTHER	0.0	0.0 *	0.0	0.0 *	0.0
40	GOV'T COMPENSATION	0.0	0.0 *	0.0	0.0 *	0.0
	TOTAL	34657.68	*	35840.50	*	96.7

Table 30

TOTAL ENERGY USED IN 1967 TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND, BY SECTOR

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.39E 02	7.82E 00	4.64F-01	4.55E 03	1.80E 00	0.39	0.30	0.53	0.35
2	MINING	2.80E 01	2.30E 00	2.49E-01	4.51E-01	2.25E-01	0.11	0.16	0.05	0.34
3	CONSTRUCTION	1.89E 03	1.09E 02	6.45E 03	5.15E 01	2.69E 01	5.44	4.11	5.95	5.27
4	ORDNANCE	5.01E 03	1.75E 02	2.22F 01	4.52E 01	5.10E 01	8.74	14.16	5.23	10.00
5	FOOD KINDRED & TCBACCO	1.06E 03	5.65E 01	3.82E 00	2.42E 01	1.68E 01	2.82	2.44	2.80	3.29
6	FABRICS & TEXTILES	3.04E 02	2.32E 01	2.50E 00	8.18E 03	6.47E 00	1.16	1.59	0.95	1.27
7	APPAREL & FABRICATED TEXTILES	4.37E 02	1.96E 01	2.09E 00	8.03E-01	5.83E-01	0.98	1.34	0.84	1.37
8	LUMBER, WOODEN CONTAINERS	4.80E 01	2.20E 00	1.96E-01	7.27E-01	6.86E-01	0.11	0.12	0.09	0.11
9	FURNITURE	4.80E 01	2.45F 00	4.63F-01	1.87E 00	2.14E 00	0.12	0.13	0.08	0.13
10	PAPER & PAPER PRODUCTS	1.37E 02	6.15E 03	5.30E-01	1.93E 03	2.14E 00	0.35	0.30	0.22	0.42
11	PRINTING	7.06E 02	1.51E 02	1.45F 01	3.63E 01	5.90E 01	0.31	0.34	0.22	0.30
12	CHEMICALS, PLASTICS, DRUGS, ETC	9.14E 02	1.79E 02	4.42E 00	9.16E 01	4.52E 01	7.52	9.26	4.20	11.55
13	PETROLEUM REFINING & PRODUCTS	1.72E 02	1.28E 01	1.24E 00	3.89E 03	3.87E 00	8.95	2.82	10.59	8.34
14	RUBBER & MISC. PLASTIC PRODUCTS	1.06E 02	3.66E 03	3.33E-01	1.34E 00	9.97E-01	0.64	0.79	0.45	0.76
15	LEATHER, TANNING, FOOTWEAR	2.42E 01	2.94E 03	1.88E-01	5.25E-01	1.62E 00	0.18	0.21	0.16	0.20
16	GLASS, STONE & CLAY PRODUCTS	1.01E 02	2.13E 01	8.85E-01	3.18E 00	4.28E 00	0.15	0.12	0.06	0.32
17	PRIMARY IRON & STEEL MANUF	1.25E 02	1.19E 01	2.50E 00	2.40E 00	5.38E 00	1.06	0.56	0.37	0.84
18	PRIMARY NONFERROUS MANUF	2.05E 02	1.71E 01	1.32E 00	3.68E 03	4.50E 00	0.59	1.59	0.28	1.35
19	METAL CONTAINER, MOLDING, STAMP	2.23E 02	1.37E 01	1.13E 00	3.17E 00	3.34E 00	0.85	0.84	0.43	0.88
20	ENGINES & TURBINES	1.04E 03	4.98E 01	4.28F 00	1.24E 01	1.32E 01	0.69	0.72	0.37	3.55
21	FARM MACH & EQUIPMENT	5.24E 03	1.81E 02	2.02F 01	5.41E 01	5.97E 01	2.49	2.73	1.43	2.58
22	COMMUNICATION & OTHER ELECT EQ	9.15E 02	5.71E 01	4.45E 00	1.30E 01	1.46E 01	9.05	12.87	6.26	11.70
23	MOTOR VEHICLES & EQUIP	8.63E 03	2.98E 02	3.79E 01	8.75E 01	8.43E 01	2.85	2.84	1.51	2.37
24	AIRCRAFT & PARTS	1.05F 03	6.93E 01	5.40E 00	1.55E 01	1.70E 01	14.86	24.17	10.13	16.51
25	OTHER TRANSPORTATION EQUIPMENT	5.22F 02	2.20E 01	2.22E 03	6.36E 03	6.73E 00	3.46	3.45	1.79	3.34
26	PROF SCIENTIFIC & OPTICAL INSTR	0.0	0.0	0.0	0.0	0.0	1.10	1.41	0.74	1.32
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	2.75E 03	4.03F 02	4.84E 03	3.43E 02	3.79E 01	20.13	3.09	39.64	7.43
32	COMMUNICATION EXC RADIO, TV	3.34E 02	5.43E 00	5.86E-01	2.89E 00	1.55E 00	0.27	0.37	0.33	0.30
33	ELECTRIC, GAS, WATER	1.90E 02	1.64E 01	2.84E 00	2.95F 00	8.49E 00	0.82	1.81	0.34	1.56
34	WHOLESALE, RETAIL	7.64E 02	2.17E 01	2.09E 00	1.14E 01	6.19E 00	1.08	1.33	1.32	1.21
35	FINANCE	9.34E 01	1.57E 00	1.47E-01	7.02E-01	5.11E-01	0.08	0.09	0.08	0.09
36	SERVICES	1.81E 03	5.07E 01	5.98E 00	2.12E 01	1.73E 01	2.53	3.82	2.45	3.38
37	GOV'T ENTERPRISE	7.30E 01	2.33F 00	1.89F-01	1.07E 00	8.63E-01	0.12	0.12	0.12	0.17
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.52E 04	2.00E 03	1.57E 02	8.65E 02	5.11E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.71E 04	1.38E 03	1.33E 02	4.25E 02	4.09E 02	69.02	84.80	49.17	80.07
	TRANSPORTATION TOTAL	2.75E 03	4.03E 02	4.84E 03	3.43E 02	3.79E 01	20.13	3.09	39.64	7.43
	ALL OTHERS	5.32E 03	2.17E 02	1.90E 01	9.67E 01	6.38E 01	10.84	12.11	11.18	12.50

Table 31

DIRECT ENERGY USED BY SECTORS TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND IN 1967

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.39E 02	2.51E 00	1.11E-01	2.04E 00	3.12E-01	0.33	0.22	0.42	0.21
2	MINING	2.80E 01	1.36E 00	1.65E-01	1.40E-01	1.40E-02	0.18	0.33	0.04	0.01
3	CONSTRUCTION	1.89E 03	2.63E 01	7.15E-01	2.42E 01	1.39E 00	3.47	1.43	5.04	0.93
4	ORDNANCE	5.01E 03	2.48E 01	5.97E 00	3.27E 00	6.66E 00	3.27	11.95	0.68	4.46
5	FOOD KINDRED & TOBACCO	1.06E 03	1.20E 01	9.43E-01	3.12E 00	4.75E 00	1.59	1.89	0.65	3.18
6	FABRICS & TEXTILES	3.04E 02	4.11E 00	7.90E-01	1.11E 00	8.29E-01	0.54	1.58	0.23	0.56
7	APPAREL & FABRICATED TEXTILES	4.37E 02	1.19E 00	2.20E-01	5.02E-01	2.55E-01	0.16	0.44	0.10	0.17
8	LUMBER, WOODEN CONTAINERS	4.80E 01	2.62E-01	6.77E-02	8.20E-02	9.48E-02	0.03	0.14	0.02	0.36
9	FURNITURE	4.80E 01	2.97E-01	4.87E-02	6.97E-02	8.19E-02	0.04	0.10	0.01	0.05
10	PAPER & PAPER PRODUCTS	6.74E 01	2.75E 00	1.74E-01	5.94E-01	8.34E-01	0.36	0.35	0.12	0.56
11	PRINTING	1.37E 02	4.73E-01	1.17E-01	1.98E-01	1.36E-01	0.06	0.23	0.04	0.39
12	CHEMICALS, PLASTICS, DRUGS, ETC	7.06E 02	9.41E 01	9.77E 00	1.95E 01	3.81E 01	12.43	19.58	4.06	25.53
13	PETROLEUM REFINING & PRODUCTS	9.14E 02	1.07E 02	1.62E 00	7.39E 01	3.08E 01	14.16	3.24	15.40	20.50
14	RUBBER & MISC. PLASTIC PRODUCTS	1.72E 02	2.40E 00	3.84E-01	5.29E-01	5.08E-01	0.32	0.77	0.11	0.34
15	LEATHER, TANNING, FOOTWEAR	1.06E 02	2.68E-01	5.75E-02	1.32E-01	2.79E-02	0.04	0.12	0.03	0.32
16	GLASS, STONE & CLAY PRODUCTS	2.42E 01	1.84E 00	1.01E-01	1.86E-01	1.20E 00	0.24	0.20	0.04	0.30
17	PRIMARY IRON & STEEL MANUF	1.01E 02	1.40E 01	4.51E-01	1.50E 00	2.56E 00	1.86	0.90	0.31	1.71
18	PRIMARY NONFERROUS MANUF	1.25E 02	5.04E 00	1.35E 00	6.74E-01	2.64E 00	0.67	2.71	0.14	1.77
19	METAL CONTAINER, MOLDING, STAMP	2.05E 02	1.64E 00	2.95E-01	5.30E-01	6.18E-01	0.22	0.59	0.11	0.41
20	ENGINES & TURBINES	2.23E 02	2.28E 00	2.61E-01	5.66E-01	3.61E-01	0.30	0.52	0.12	0.24
21	FARM MACH & EQUIPMENT	1.04E 03	5.40E 00	9.81E-01	1.69E 00	1.48E 00	0.71	1.96	0.35	0.99
22	COMMUNICATION & OTHER ELECT EQ	5.24E 03	2.91E 01	4.84E 00	9.42E 00	1.13E 01	3.84	9.69	1.96	7.54
23	MOTOR VEHICLES & EQUIP	9.15E 02	4.17E 00	7.42E-01	6.48E-01	1.02E 00	0.55	1.49	0.14	0.53
24	AIRCRAFT & PARTS	8.63E 03	3.67E 01	1.09E 01	1.44E 01	5.97E 00	4.84	21.85	3.01	4.00
25	OTHER TRANSPORTATION EQUIPMENT	1.05E 03	7.35E 00	1.19E 00	1.19E 00	1.48E 00	0.97	2.38	0.25	0.99
26	PROF SCIENTIFIC & OPTICAL INSTR	5.22E 02	2.89E 00	4.28E-01	9.92E-01	5.85E-01	0.38	0.86	0.21	0.39
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	2.75E 03	3.26E 02	1.30E 00	3.02E 02	1.84E 01	43.15	2.61	62.91	12.30
32	COMMUNICATV EXC RADIO, TV	3.34E 02	3.09E 00	3.98E-01	1.82E 00	8.35E-01	0.40	0.80	0.38	0.56
33	ELECTRIC, GAS, WATER	1.90E 02	8.46E 00	1.98E 00	8.04E-01	5.49E 00	1.12	3.98	0.17	3.53
34	WHOLESALE, RETAIL	7.64E 02	1.16E 01	1.29E 00	7.30E 00	2.99E 00	1.53	2.58	1.52	2.01
35	FINANCE	9.34E 01	3.26E-01	5.40E-02	1.15E-01	1.57E-01	0.04	0.11	0.02	0.10
36	SERVICES	1.81E 03	1.38E 01	1.91E 00	5.93E 00	5.98E 00	1.83	3.83	1.24	4.01
37	GOV'T ENTERPRISE	7.30E 01	2.57E 00	2.81E-01	7.70E-01	1.52E 00	0.34	0.56	0.16	1.02
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.52E 04	7.57E 02	4.99E 01	4.83E 02	1.49E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.71E 04	3.60E 02	4.17E 01	1.35E 02	1.12E 02	47.60	83.55	28.10	75.18
	TRANSPORTATION TOTAL	2.75E 03	3.26E 02	1.30E 00	3.02E 02	1.84E 01	43.15	2.61	62.90	12.30
	ALL OTHERS	5.32E 03	7.00E 01	6.91E 00	4.31E 01	1.87E 01	9.25	13.85	8.99	12.52

Table 32

ENERGY CONSUMED IN 1967 BY ULTIMATE USER TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.31E 03	2.09E 01	1.04E 00	1.68E 01	2.57E 00	1.03	0.65	1.92	0.50
2	MINING	1.45E 03	1.02E 02	5.81E 01	8.39E 00	1.74E 01	5.04	3.45	0.96	3.35
3	CONSTRUCTION	2.48E 03	3.77E 01	9.51E 01	3.48E 01	1.90E 00	1.86	0.61	3.99	0.37
4	IRON AND STEEL	5.40E 03	2.67E 01	6.42E 00	3.52E 03	7.16E 00	1.32	4.02	0.40	1.38
5	FOOD KINDRED & TOBACCO	1.74E 03	1.96E 01	1.54E 00	5.08E 00	7.72E 00	0.97	0.96	0.58	1.49
6	FABRICS & TEXTILES	1.00E 03	1.32E 01	2.55E 00	3.57E 03	2.71E 00	0.65	1.59	0.41	0.52
7	APPAREL & FABRICATED TEXTILES	6.44E 02	1.75E 00	3.25E 01	7.28E 01	3.75E 01	0.09	0.20	0.08	0.37
8	LUMBER, WOODEN CONTAINERS	5.05E 02	4.32E 00	7.25E 01	1.92E 03	1.35E 00	0.21	0.45	0.22	0.26
9	FURNITURE	2.04E 02	1.25E 00	2.06E 01	3.28E 01	3.08E 01	0.06	0.13	0.04	0.06
10	PAPER & PAPER PRODUCTS	8.74E 02	4.89E 01	2.84E 00	1.03E 01	1.46E 01	2.41	1.78	0.14	2.83
11	PRINTING	8.40E 02	2.91E 00	7.19E 01	1.22E 00	8.35E 01	0.14	0.45	0.14	0.16
12	CHEMICALS, PLASTICS, DRUGS, ETC	2.34E 03	2.80E 02	2.76E 01	6.47E 01	1.08E 02	13.81	17.29	7.42	20.80
13	PETROLEUM REFINING & PRODUCTS	1.65E 03	1.93E 02	2.92E 03	1.33E 02	5.55E 01	9.55	1.83	15.26	10.71
14	RUBBER & MISC. PLASTIC PRODUCTS	7.82E 02	1.09E 01	1.74E 00	2.40E 03	2.31E 00	0.54	1.09	0.28	0.45
15	LEATHER, TANNING, FOOTWEAR	1.58E 02	1.12E 00	1.01E 01	4.40E 01	2.09E 01	0.06	0.06	0.05	0.34
16	GLASS, STONE & CLAY PRODUCTS	5.17E 02	4.03E 01	2.20E 03	4.23E 03	2.48E 01	1.99	1.37	0.49	4.80
17	PRIMARY IRON & STEEL MANUF	2.33E 03	3.25E 02	1.04E 01	3.46E 01	5.91E 01	16.00	6.52	3.96	11.42
18	PRIMARY NONFERROUS MANUF	2.36E 03	9.51E 01	2.56E 01	1.27E 01	4.98E 01	4.70	1.67	1.46	9.51
19	METAL CONTAINER, MOLDING, STAMP	1.91E 03	1.63E 01	2.66E 00	5.33E 03	6.21E 00	0.80	1.67	0.61	1.20
20	ENGINES & TURBINES	3.85E 02	3.94E 03	4.51E 01	9.76E 01	6.22E 01	0.19	0.28	0.11	3.12
21	FARM MACH & EQUIPMENT	3.20E 03	1.83F 01	3.58E 00	6.17E 03	5.40E 00	0.90	2.24	0.71	1.04
22	COMMUNICATION & OTHER ELECT EQ	8.84E 03	4.98E 01	9.21E 00	1.66E 01	1.80E 01	2.46	5.76	1.90	3.48
23	MOTOR VEHICLES & EQUIP	1.63E 03	7.45E 03	1.33E 00	1.16E 00	1.82E 00	0.37	0.83	0.13	0.35
24	AIRCRAFT & PARTS	1.23E 04	5.24E 01	1.56E 01	2.06E 01	8.55E 00	2.59	9.77	2.36	1.65
25	OTHER TRANSPORTATION EQUIPMENT	1.23E 03	8.62E 00	1.39E 00	1.39E 00	1.74E 00	0.43	0.87	0.16	0.34
26	PROF SCIENTIFIC & OPTICAL INSTR	1.24E 03	6.69E 00	1.02E 03	2.12E 03	1.36E 00	0.33	0.64	0.24	0.26
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	4.37E 03	4.64E 02	2.28E 03	4.14E 02	4.04E 01	22.93	1.42	47.42	7.81
32	COMMUNICATION EXC RADIO, TV	9.76E 02	8.30E 00	1.15E 00	4.73E 00	2.41E 00	0.41	0.72	0.54	3.47
33	ELECTRIC, GAS, WATER	1.15E 03	5.10E 01	1.20E 01	4.54E 03	3.31E 01	2.52	7.48	0.55	5.38
34	WHOLESALE, RETAIL	2.77E 03	4.21E 01	4.68E 00	2.65E 01	1.09E 01	2.08	2.93	3.04	2.10
35	FINANCE	1.99E 03	8.88E 00	1.54E 00	3.18E 00	4.16E 00	0.44	0.97	0.36	0.80
36	SERVICES	4.82E 03	4.81E 01	7.84E 03	2.21E 01	1.82E 01	2.37	4.90	2.53	3.51
37	GOV'T ENTERPRISE	5.86E 02	1.46E 01	1.67E 00	4.30E 00	8.64E 00	0.72	1.05	0.49	1.57
38	IMPORT	1.31E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	7.34E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	7.61E 04	2.02E 03	1.60E 02	8.73E 02	5.18E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	5.21E 04	1.23E 03	1.21E 02	3.33E 02	3.78E 02	60.60	75.81	38.19	73.35
	TRANSPORTATION TOTAL	4.36E 03	4.64E 02	2.28E 00	4.14E 02	4.04E 01	22.93	1.42	47.42	7.31
	ALL OTHERS	1.96E 04	3.34E 02	3.64E 01	1.26E 02	9.91E 01	16.48	22.77	14.39	19.14

Table 33

1968 DEPARTMENT OF DEFENSE EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	* 1958 DOLLARS (MILLIONS)	PERCENT *	1963 DOLLARS (MILLIONS)	PERCENT *	DEFLATOR 63=100.
1	AGRICULTURE	234.73	0.52 *	134.58	0.45 *	110.9
2	MINING	27.30	0.07 *	27.53	0.07 *	99.0
3	CONSTRUCTION	1451.20	3.67 *	1488.41	3.65 *	97.5
4	TRANSPORTATION	6152.30	15.56 *	6545.00	16.03 *	94.0
5	FOOD KINDRED & TURACCO	1321.00	3.34 *	1331.65	3.26 *	99.2
6	FABRICS & TEXTILES	231.60	0.59 *	235.13	0.58 *	98.5
7	APPAREL & FABRICATED TEXTILES	396.50	1.01 *	404.57	0.99 *	98.5
8	LUMBER, WOODEN CONTAINERS	30.00	0.08 *	30.36	0.07 *	98.8
9	FURNITURE	39.63	0.10 *	38.79	0.09 *	102.1
10	PAPER & PAPER PRODUCTS	52.30	0.13 *	51.63	0.13 *	100.9
11	PRINTING	226.00	0.57 *	223.98	0.55 *	100.9
12	CHEMICALS, PLASTICS, DRUGS, ETC	686.40	1.74 *	658.26	1.61 *	104.3
13	PETROLEUM REFINING & PRODUCTS	1414.00	3.58 *	1422.54	3.48 *	99.4
14	RUBBER & MISC. PLASTIC PRODUCTS	219.90	0.56 *	206.09	0.50 *	106.7
15	LEATHER, TANNING, FOOTWEAR	73.90	0.20 *	85.61	0.21 *	92.1
16	GLASS, STONE & CLAY PRODUCTS	25.80	0.06 *	25.96	0.06 *	98.6
17	PRIMARY IRON & STEEL MANUF	89.20	0.22 *	87.50	0.21 *	100.8
18	PRIMARY NONFERROUS MANUF	103.70	0.26 *	107.57	0.26 *	96.4
19	METAL CONTAINER, MULDING, STAMP	260.80	0.66 *	263.43	0.65 *	99.0
20	ENGINES & TURBINES	241.00	0.61 *	246.17	0.60 *	97.9
21	FARM MACH & EQUIPMENT	1096.60	2.75 *	1120.12	2.74 *	97.9
22	COMMUNICATION & OTHER ELECT EQ	6380.60	16.16 *	6200.77	15.19 *	102.9
23	MOTOR VEHICLES & EQUIP	973.20	2.46 *	970.29	2.38 *	100.3
24	AIRCRAFT & PARTS	8798.30	22.28 *	9359.89	22.92 *	94.0
25	OTHER TRANSPORTATION EQUIPMENT	1095.00	2.77 *	1091.73	2.67 *	100.3
26	PROF SCIENTIFIC & OPTICAL INSTR	811.90	2.06 *	791.02	1.94 *	102.6
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
31	GENERAL TRANSPORTATION	3108.80	7.87 *	3360.86	8.23 *	92.5
32	COMMUNICATION EXC RADIO, TV	376.00	0.95 *	404.30	0.99 *	93.0
33	ELECTRIC, GAS, WATER	240.50	0.61 *	258.60	0.63 *	93.0
34	WHOLESALE, RETAIL	1023.00	2.59 *	1083.69	2.65 *	94.4
35	FINANCE	80.80	0.22 *	93.23	0.23 *	93.1
36	SERVICES	2173.40	5.50 *	2345.69	5.74 *	92.7
37	GOV'T ENTERPRISE	76.00	0.19 *	86.27	0.21 *	88.1
38	IMPORT	0.0	0.0 *	0.0	0.0 *	0.0
39	OTHER	0.0	0.0 *	0.0	0.0 *	0.0
40	GOV'T COMPENSATION	0.0	0.0 *	0.0	0.0 *	0.0
	TOTAL	39493.04	*	40831.44	*	96.7

Table 34

TOTAL ENERGY USED IN 1968 TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND, BY SECTOR

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.85E 02	9.93E 00	6.21E-01	5.71E 00	1.28E 00	0.43	0.35	0.56	0.39
2	MINING	2.76E 01	2.28E 00	2.46E-01	4.48E-01	2.45E-01	0.10	0.14	0.04	0.04
3	CONSTRUCTION	1.49E 03	8.28E 01	5.06E 00	4.05E 01	2.12E 01	3.69	2.88	3.94	3.63
4	ORONANCE	6.54E 03	2.29E 02	2.90E 01	5.90E 01	6.66E 01	9.85	16.49	5.73	11.42
5	FOOD KINDRED & TOBACCO	1.33E 03	7.11E 01	4.82E 00	3.05E 01	2.12E 01	3.06	2.74	2.96	3.63
6	FABRICS & TEXTILES	2.35E 02	1.78E 01	1.90E 00	6.28E 00	4.99E 00	0.77	1.08	0.61	0.85
7	APPAREL & FABRICATED TEXTILES	4.05E 02	1.82E 01	1.93E 00	6.09E 00	5.06E 00	0.78	1.10	0.65	0.87
8	LUMBER, WOODEN CONTAINERS	3.04E 01	1.34E 00	1.21E-01	5.13E-01	3.63E-01	0.06	0.07	0.05	0.06
9	FURNITURE	3.88E 01	2.03E 00	1.70E-01	5.78E-01	5.75E-01	0.09	0.10	0.06	0.10
10	PAPER & PAPER PRODUCTS	5.18E 01	5.42E 00	3.58E-01	1.45E 00	1.66E 00	0.23	0.20	0.14	0.29
11	PRINTING	2.24E 02	1.01E 01	6.69E-01	3.17E 00	3.16E 00	0.43	0.49	0.31	0.54
12	CHEMICALS, PLASTICS, ORLGS, ETC	6.58E 02	1.36E 02	1.31E 01	3.35E 01	5.31E 01	5.87	7.44	3.26	9.10
13	PETROLEUM REFINING & PRODUCTS	1.42E 03	2.79E 02	6.87E 00	1.42E 02	7.03E 01	12.02	3.91	13.84	12.04
14	RUBBER & MISC. PLASTIC PRODUCTS	2.06E 02	1.94E 01	1.48E 00	4.65E 00	4.63E 00	0.66	0.84	0.45	0.79
15	LEATHER, TANNING, FOOTWEAR	8.57E 01	2.96E 00	2.68E-01	1.00E 00	8.04E-01	0.13	0.15	0.11	0.14
16	GLASS, STONE & CLAY PRODUCTS	2.60E 01	3.14E 00	2.01E-01	5.60E-01	1.74E 00	0.14	0.11	0.05	0.30
17	PRIMARY IRON & STEEL MANUF	8.75E 01	1.85E 01	7.67E-01	2.76E 00	3.71E 00	0.79	0.44	0.27	0.64
18	PRIMARY NONFERROUS MANUF	1.08E 02	1.02E 01	2.15E 00	2.06E 00	4.63E 00	0.44	1.22	0.20	0.79
19	METAL CONTAINER, MCLDNG, STAMP	2.63E 02	2.18E 01	1.70E 00	4.70E 00	5.79E 00	0.94	0.97	0.46	0.99
20	ENGINES & TURBINES	2.46E 02	1.51E 01	1.24E 00	3.49E 00	3.68E 00	0.65	0.71	0.34	0.63
21	FARM MACH & EQUIPMENT	1.12E 03	5.68E 01	4.78E 00	1.38E 01	1.50E 01	2.45	2.72	1.34	2.57
22	COMMUNICATION & OTHER ELECT EQ	6.20E 03	2.12E 02	2.36E 01	6.37E 01	7.00E 01	9.13	13.42	6.19	12.01
23	MOTOR VEHICLES & EQUIP	9.70E 02	6.05E 01	4.72E 00	1.38E 01	1.55E 01	2.61	2.69	1.34	2.66
24	AIRCRAFT & PARTS	9.36E 03	3.23E 02	4.11E 01	9.50E 01	9.14E 01	13.90	23.40	9.23	15.68
25	OTHER TRANSPORTATION EQUIPMENT	1.09E 03	7.23E 01	5.64E 00	1.61E 01	1.78E 01	3.11	3.21	1.57	3.35
26	PROF SCIENTIFIC & OPTICAL INSTR	7.91E 02	3.49E 01	3.39E 00	1.02E 01	1.07E 01	1.50	1.93	0.99	1.83
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	3.36E 03	4.93E 02	5.92E 00	4.19E 02	4.64E 01	21.24	3.37	40.74	7.95
32	COMMUNICATION EXC RADIO, TV	4.04E 02	6.58E 00	7.10E-01	3.50E 00	1.88E 00	0.28	0.40	0.34	0.32
33	ELECTRIC, GAS, WATER	2.59E 02	2.23E 01	3.86E 00	4.01E 00	1.16E 01	0.96	2.20	0.39	1.98
34	WHOLESALE, RETAIL	1.08E 03	3.07E 01	2.96E 00	1.62E 01	8.79E 00	1.32	1.68	1.58	1.51
35	FINANCE	9.32E 01	1.59E 00	1.51E-01	7.04E-01	5.20E-01	0.07	0.09	0.07	0.09
36	SERVICES	1.81E 03	5.38E 01	5.82E 00	2.14E 01	1.72E 01	2.19	3.31	2.08	2.95
37	GOV'T ENTERPRISE	8.63E 01	2.69E 00	2.16E-01	1.25E 00	9.86E-01	0.12	0.12	0.12	0.17
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL		4.03E 04	2.32E 03	1.76E 02	1.03E 03	5.83E 02	100.00	100.00	100.00	100.00
MANUFACTURING TOTAL		3.15E 04	1.62E 03	1.50E 02	5.16E 02	4.72E 02	69.61	85.45	50.15	80.98
TRANSPORTATION TOTAL		3.36E 03	4.93E 02	5.92E 00	4.19E 02	4.64E 01	21.24	3.37	40.74	7.95
ALL OTHERS		5.43E 03	2.13E 02	1.96E 01	9.37E 01	6.46E 01	9.15	11.19	9.11	11.07

Table 35
DIRECT ENERGY USED BY SECTORS TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND IN 1968

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.85E 02	2.59E 00	1.50E-01	2.04E 00	3.12E-01	0.29	0.27	0.34	0.18
2	MINING	2.76E 01	1.35E 00	1.63E-01	1.94E-01	3.54E-02	0.15	0.29	0.03	0.02
3	CONSTRUCTION	1.49E 03	2.07E 01	5.63E-01	1.90E 01	1.09E 00	2.29	1.02	3.22	0.62
4	CRONANCE	6.54E 03	3.23E 01	7.79E 00	4.26E 00	8.69E 00	3.58	14.07	0.72	4.94
5	FOOD KINDREO & TOBACCO	1.33E 03	1.52E 01	1.19E 00	3.93E 00	5.98E 00	1.68	2.14	0.66	3.40
6	FABRICS & TEXTILES	2.35E 02	3.06E 00	5.89E-01	8.23E-01	6.33E-01	0.34	1.06	0.14	0.36
7	APPAREL & FABRICATED TEXTILES	4.05E 02	1.10E 00	2.03E-01	4.65E-01	2.36E-01	0.12	0.37	0.08	0.13
8	LUMBER, WOODEN CONTAINERS	3.04E 01	1.93E-01	4.31E-02	7.06E-02	6.62E-02	0.02	0.08	0.01	0.04
9	FURNITURE	3.88E 01	2.43E-01	3.97E-02	4.98E-02	7.45E-02	0.03	0.07	0.01	0.04
10	PAPER & PAPER PRODUCTS	5.18E 01	2.18E 00	1.37E-01	4.71E-01	6.62E-01	0.24	0.25	0.08	0.38
11	PRINTING	2.24E 02	7.76E-01	1.92E-01	3.24E-01	2.23E-01	0.09	0.35	0.05	0.13
12	CHEMICALS, PLASTICS, DRUGS, ETC	6.58E 02	8.42E 01	8.71E 00	1.79E 01	3.39E 01	9.31	15.74	3.03	19.27
13	PETROLEUM REFINING & PRODUCTS	1.42E 03	1.67E 02	2.52E 00	1.15E 02	4.78E 01	18.44	4.55	19.43	27.18
14	RUBBER & MISC. PLASTIC PRODUCTS	2.06E 02	2.87E 00	4.60E-01	6.33E-01	2.08E-01	0.32	0.83	0.11	0.35
15	LEATHER, TANNING, FOOTWEAR	8.57E 01	2.23E-01	4.65E-02	1.09E-01	2.42E-02	0.02	0.08	0.02	0.01
16	GLASS, STONE & CLAY PRODUCTS	2.60E 01	1.96E 00	1.08E-01	1.98E-01	1.29E 00	0.22	0.19	0.03	0.73
17	PRIMARY IRON & STEEL MANUF	8.75E 01	1.22E 01	3.91E-01	1.30E 00	2.22E 00	1.35	0.71	0.22	1.26
18	PRIMARY NONFERROUS MANUF	1.08E 02	4.33E 00	1.16E 00	5.79E-01	2.27E 00	0.48	2.10	0.10	1.29
19	METAL CONTAINER, MOLDING, STAMP	2.63E 02	2.15E 00	3.80E-01	6.87E-01	8.23E-01	0.24	0.69	0.12	0.47
20	ENGINES & TURBINES	2.46E 02	2.52E 00	2.68E-01	6.24E-01	3.98E-01	0.28	0.52	0.11	0.23
21	FARM MACH & EQUIPMENT	1.12E 03	6.25E 00	1.09E 00	1.84E 00	1.79E 00	0.69	1.97	0.31	1.02
22	COMMUNICATION & OTHER ELECT EQ	6.20E 03	3.45E 01	5.63E 00	1.13E 01	1.35E 01	3.82	10.18	1.90	7.66
23	MOTOR VEHICLES & EQUIP	9.70E 02	4.43E 00	7.87E-01	6.87E-01	1.08E 00	0.49	1.42	0.12	0.61
24	AIRCRAFT & PARTS	9.36E 03	3.97E 01	1.18E 01	1.56E 01	6.48E 00	4.40	21.38	2.64	3.68
25	OTHER TRANSPORTATION EQUIPMENT	1.09E 03	7.67E 00	1.24E 00	1.24E 00	1.55E 00	0.85	2.24	0.21	0.88
26	PROF SCIENTIFIC & OPTICAL INSTR	7.91E 02	5.56E 00	6.35E-01	1.98E 00	9.20E-01	0.61	1.15	0.33	0.52
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	3.36E 03	3.99E 02	1.59E 00	3.69E 02	2.24E 01	44.16	2.88	62.37	12.75
31	GENERAL TRANSPORTATION	4.04E 02	3.70E 00	4.83E-01	2.20E 00	1.01E 00	0.41	0.87	0.37	0.57
32	COMMUNICATION EXC RADIO, TV	2.59E 02	1.15E 01	2.70E 00	1.09E 00	7.46E 00	1.27	4.88	0.18	4.24
33	ELECTRIC, GAS, WATER	1.08E 03	1.64E 01	1.83E 00	1.04E 01	4.25E 00	1.82	3.31	1.75	2.41
34	WHOLESALE, RETAIL	9.32E 01	3.40E-01	5.70E-02	1.20E-01	1.63E-01	0.04	0.10	0.02	0.09
35	FINANCE	1.61E 03	1.48E 01	2.01E 00	6.66E 00	6.18E 00	1.64	3.63	1.13	3.51
36	SERVICES	8.63E 01	3.09E 00	3.38E-01	9.25E-01	1.82E 00	0.34	0.61	0.16	1.04
37	GOV'T ENTERPRISE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	4.03E 04	9.04E 02	5.53E 01	5.92E 02	1.76E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	3.15E 04	4.30E 02	4.55E 01	1.80E 02	1.31E 02	47.60	82.14	30.43	74.56
	TRANSPORTATION TOTAL	3.36E 03	3.99E 02	1.59E 00	3.69E 02	2.24E 01	44.16	2.68	62.37	12.75
	ALL OTHERS	5.43E 03	7.46E 01	8.29E 00	4.26E 01	2.23E 01	8.25	14.98	7.21	12.69

Table 36

ENERGY CONSUMED IN 1968 BY ULTIMATE USER TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.58E 03	2.43E 01	1.26E 00	1.94E 01	2.97E 00	1.04	0.71	1.87	0.50
2	MINING	1.81E 03	1.30E 02	6.39E 00	9.66E 00	2.07E 01	5.56	3.59	0.93	3.51
3	CONSTRUCTION	2.17E 03	3.40E 01	8.73E 01	3.14E 01	1.69E 00	1.45	4.49	3.03	0.29
4	TRANSPORTATION	7.00E 03	3.46E 01	8.33E 00	4.56E 00	9.30E 00	1.48	4.67	0.44	1.58
5	FOOD KINDRED & TOBACCO	2.14E 03	2.42E 01	1.89E 00	6.26E 00	9.52E 00	1.03	1.06	0.60	1.62
6	FABRICS & TEXTILES	8.9E 02	1.17E 01	2.24E 00	3.13E 00	2.42E 00	0.50	1.26	0.30	0.41
7	APPAREL & FABRICATED TEXTILES	6.17E 02	1.67E 00	3.11E 01	6.96E 01	3.59E 01	0.07	0.17	0.07	0.06
8	LUMBER, WOODEN CONTAINERS	4.88E 02	4.23E 00	7.02E 01	1.90E 00	1.31E 00	0.18	3.39	0.18	0.22
9	FURNITURE	2.18E 02	1.34E 00	2.20E 01	3.50E 01	3.30E 01	0.06	0.12	0.03	0.06
10	PAPER & PAPER PRODUCTS	9.75E 02	5.50E 01	3.18E 00	1.16E 01	1.65E 01	2.35	1.79	1.12	2.79
11	PRINTING	1.01E 03	3.49E 00	8.62E 01	1.46E 01	1.00E 00	0.15	0.48	0.14	0.17
12	CHEMICALS, PLASTICS, DRUGS, ETC	2.44E 03	2.88E 02	2.84E 01	6.73E 01	1.11E 02	12.33	15.96	6.50	18.81
13	PETROLEUM REFINING & PRODUCTS	2.27E 03	2.86E 02	4.02E 00	1.84E 02	7.65E 01	11.39	2.26	17.73	12.97
14	RUBBER & MISC. PLASTIC PRODUCTS	5.03E 02	1.26E 01	2.01E 00	2.78E 00	2.67E 00	0.54	1.13	0.27	0.45
15	LEATHER, TANNING, FOOTWEAR	1.36E 02	1.31E 00	8.81E 02	3.94E 01	1.90E 01	0.04	0.05	0.04	0.03
16	GLASS, STONE & CLAY PRODUCTS	5.44E 02	4.22E 01	2.30E 00	4.40E 01	2.63E 01	1.80	1.29	0.42	4.46
17	PRIMARY IRON & STEEL MANUF	2.58E 03	3.58E 02	1.15E 01	3.62E 01	6.53E 01	15.31	6.45	3.68	11.08
18	PRIMARY NONFERROUS MANUF	2.64E 03	1.06E 02	2.86E 01	1.42E 01	5.57E 01	4.54	16.05	1.37	9.44
19	METAL CONTAINER, MOLDING, STAMP	2.14E 03	1.84E 01	2.99E 00	6.03E 00	7.01E 00	0.78	1.68	3.58	1.19
20	ENGINES & TURBINES	4.26E 02	4.35E 00	4.98E 01	1.08E 00	6.88E 01	0.19	0.28	0.10	0.12
21	ARM MACH & EQUIPMENT	3.51E 03	2.06E 01	3.99E 00	6.84E 00	6.18E 00	0.88	2.24	0.66	1.05
22	COMMUNICATION & OTHER ELECT EQ	1.04E 04	5.89E 01	1.08E 01	1.58E 01	2.14E 01	2.52	6.05	1.91	3.63
23	MOTOR VEHICLES & EQUIP	1.75E 03	7.98E 00	1.42E 00	1.24E 00	1.95E 00	0.34	0.80	0.12	0.33
24	AIRCRAFT & PARTS	1.38E 04	5.87E 01	1.75E 01	2.31E 01	9.56E 00	2.51	9.80	2.23	1.62
25	OTHER TRANSPORTATION EQUIPMENT	1.29E 03	9.07E 00	1.47E 00	1.47E 00	1.83E 00	0.39	0.82	0.14	0.31
26	PROF SCIENTIFIC & OPTICAL INSTR	0.0	1.00E 01	1.31E 00	3.33E 00	1.81E 00	0.43	0.74	0.32	0.31
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	5.21E 03	5.57E 02	2.71E 00	4.97E 02	4.77E 01	23.79	1.52	48.00	8.09
32	COMMUNICATION EXC RADIO, TV	1.13E 03	9.65E 00	1.34E 00	5.52E 00	2.79E 00	0.41	0.75	0.53	0.47
33	ELECTRIC, GAS, WATER	1.34E 03	5.97E 01	1.40E 01	5.68E 00	3.87E 01	2.55	7.66	0.55	6.57
34	WHOLESALE, RETAIL	3.33E 03	5.04E 01	5.61E 00	3.18E 01	1.30E 01	2.16	3.15	3.07	2.21
35	FINANCE	2.28E 03	1.02E 01	1.77E 00	3.65E 00	4.77E 00	0.44	0.99	0.35	0.81
36	SERVICES	5.04E 03	4.88E 01	7.68E 00	2.28E 01	1.84E 01	2.09	4.31	2.20	3.12
37	GOV'T ENTERPRISE	6.81E 02	1.71E 01	1.96E 00	5.03E 00	1.01E 01	0.73	1.10	0.49	1.72
38	IMPORT	1.52E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	8.32E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	8.66E 04	2.34E 03	1.78E 02	1.04E 03	5.89E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	5.98E 04	1.40E 03	1.35E 02	4.04E 02	4.29E 02	59.79	75.54	38.97	72.71
	TRANSPORTATION TOTAL	5.21E 03	5.57E 02	2.71E 00	4.97E 02	4.77E 01	23.79	1.52	48.00	8.09
	ALL OTHERS	2.17E 04	3.44E 02	4.09E 01	1.35E 02	1.13E 02	16.42	22.95	13.02	19.20

Table 37

1969 DEPARTMENT OF DEFENSE EXPENDITURES FOR FINAL DEMAND, BY SECTOR, IN DOLLARS AND PERCENT

SIC	SECTOR	* 1958 DOLLARS (MILLIONS)	PERCENT *	1963 DOLLARS (MILLIONS)	PERCENT *	DEFLATOR 63=100
1	AGRICULTURE	216.50	0.58 *	195.22	C.51 *	110.9
2	MINING	34.30	0.09 *	34.66	0.09 *	99.0
3	CONSTRUCTION	1460.40	3.94 *	1497.85	3.90 *	97.5
4	ORDNANCE	6514.00	17.55 *	6929.79	18.05 *	94.0
5	FOOD KINDRED & TOBACCO	1152.00	3.10 *	1161.29	3.03 *	99.2
6	FABRICS & TEXTILES	174.10	0.47 *	176.75	C.46 *	98.5
7	APPAREL & FABRICATED TEXTILES	310.40	0.84 *	315.13	0.82 *	98.5
8	LUMBER, WOODEN CONTAINERS	20.80	0.06 *	21.05	0.05 *	98.8
9	FURNITURE	27.90	0.08 *	27.33	C.07 *	102.1
10	PAPER & PAPER PRODUCTS	44.70	0.12 *	44.30	0.12 *	100.9
11	PRINTING	190.60	0.51 *	188.90	C.49 *	100.9
12	CHEMICALS, PLASTICS, DRUGS, ETC	634.70	1.71 *	608.75	1.59 *	104.3
13	PETROLEUM REFINING & PRODUCTS	1430.00	3.85 *	1438.63	3.75 *	99.4
14	RUBBER & MISC. PLASTIC PRODUCTS	172.00	0.46 *	161.20	C.42 *	106.7
15	LEATHER, TANNING, FURTWARE	65.60	0.18 *	71.23	0.19 *	92.1
16	GLASS, STONE & CLAY PRODUCTS	26.00	0.07 *	26.37	C.07 *	98.6
17	PRIMARY IRON & STEEL MANUF	65.40	0.18 *	64.88	0.17 *	100.8
18	PRIMARY NONFERROUS MANUF	79.40	0.21 *	82.37	C.21 *	96.4
19	METAL CONTAINER, MOLDING, STAMP	244.60	0.66 *	247.07	C.64 *	99.0
20	ENGINES & TURBINES	215.20	0.58 *	219.82	0.57 *	97.9
21	FARM MACH & EQUIPMENT	521.80	2.48 *	941.57	2.45 *	97.9
22	COMMUNICATION & CIPHER ELECT EQ	6057.20	16.32 *	5886.49	15.34 *	102.9
23	MOTOR VEHICLES & EQUIP	719.00	1.94 *	716.85	1.87 *	100.3
24	AIRCRAFT & PARTS	7926.10	21.36 *	8432.02	21.97 *	94.0
25	OTHER TRANSPORTATION EQUIPMENT	1125.00	3.03 *	1121.64	2.92 *	100.3
26	PROF SCIENTIFIC & OPTICAL INSTR	744.10	2.01 *	724.89	1.89 *	102.7
27	AIR PASSENGER TRANSPORTATION	0.0	0.0 *	0.0	C.0 *	0.0
28	AIR CARGO TRANSPORTATION	C.0	0.0 *	0.0	0.0 *	0.0
29	VESSEL TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0 *	0.0	0.0 *	0.0
31	GENERAL TRANSPORTATION	2803.00	7.55 *	3030.27	7.89 *	92.5
32	COMMUNICATION EXC RADIO, TV	325.00	0.88 *	349.46	0.91 *	93.0
33	ELECTRIC, GAS, WATER	252.10	0.68 *	271.08	0.71 *	93.0
34	WHOLESALE, RETAIL	505.00	2.44 *	958.69	2.50 *	94.4
35	FINANCE	87.90	0.24 *	94.41	0.25 *	93.1
36	SERVICES	2087.80	5.63 *	2254.22	5.87 *	92.6
37	GOV'T ENTERPRISE	78.40	0.21 *	89.00	C.23 *	88.1
38	IMPORT	0.0	0.0 *	0.0	C.0 *	0.0
39	OTHER	0.0	0.0 *	0.0	0.0 *	0.0
40	GOV'T COMPENSATION	0.0	0.0 *	0.0	C.0 *	0.0
	TOTAL	37110.92	*	38383.03	*	96.7

Table 38

TOTAL ENERGY USED IN 1969 TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND, BY SECTOR

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OIL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.95E 02	1.05E 01	6.58E-01	6.05E 00	2.42E CC	0.48	0.40	0.63	0.44
2	MINING	3.47E 01	2.86E 00	3.09E-01	5.61E-01	2.99E-C1	0.13	0.19	0.06	0.05
3	CONSTRUCTION	1.50E 03	8.65E 01	5.14E 00	4.04E 01	2.15E C1	3.97	3.10	4.22	3.90
4	ORDNANCE	6.93E 03	2.42E 02	3.07E 00	6.24E 01	7.05E 01	11.12	18.52	5.52	12.77
5	FOOD KINDRED & TOBACCO	1.16E 03	6.20E 01	4.20E 00	2.66E 01	1.85E 01	2.85	2.54	2.77	3.34
6	FABRICS & TEXTILES	1.77E 02	1.34E 01	1.44E 00	4.73E 00	3.75E CC	0.62	0.87	0.49	0.68
7	APPAREL & FABRICATED TEXTILES	3.15E 02	1.41E 01	1.50E 00	5.19E 00	3.92E 00	0.65	0.91	0.54	0.71
8	LUMBER, WOODEN CONTAINERS	2.11E 01	5.12E-01	8.30E-02	3.57E-01	2.49E-C1	0.04	0.05	0.04	0.05
9	FURNITURE	2.73E 01	1.43E 00	1.20E-01	4.08E-01	4.04E-01	0.07	0.07	0.04	0.07
10	PAPER & PAPER PRODUCTS	4.43E 01	4.66E 00	3.08E-01	1.25E 00	1.43E 00	0.21	0.19	0.13	0.26
11	PRINTING	1.89E 02	8.51E 00	7.33E-01	2.67E 00	2.66E CC	0.39	0.44	0.28	0.48
12	CHEMICALS, PLASTICS, DRUGS, ETC	6.09E 02	1.31E 02	1.27E 01	3.15E 01	5.14E 01	6.02	7.65	3.29	9.31
13	PETROLEUM REFINING & PRODUCTS	1.44E 03	2.82E 02	6.95E 00	1.44E 02	7.10E 01	12.97	4.20	15.05	12.86
14	RUBBER & MISC. PLASTIC PRODUCTS	1.61E 02	1.20E 01	1.16E 00	3.64E 00	3.62E 00	0.55	0.70	0.38	0.66
15	LEATHER, TANNING, FOOTWEAR	7.12E 01	2.46E 00	2.23E-01	9.02E-01	6.69E-01	0.11	0.13	0.09	0.12
16	GLASS, STONE & CLAY PRODUCTS	2.64E 01	3.25E 00	2.06E-01	5.92E-01	1.74E 00	0.15	0.12	0.06	0.32
17	PRIMARY IRON & STEEL MANUF	6.49E 01	1.37E 01	5.69E-01	2.04E 00	2.75E 00	0.63	0.34	0.21	0.50
18	PRIMARY NONFERROUS MANUF	8.24E 01	7.82E 00	1.64E 00	1.58E 00	3.54E CC	0.36	0.99	0.16	0.84
19	METAL CONTAINER, MCLDNG, STAMP	2.47E 02	2.05E 01	1.61E 00	4.40E 00	5.44E 00	0.94	0.97	0.46	0.98
20	ENGINES & TURBINES	2.20E 02	1.35E 01	1.11E 00	3.12E 00	3.29E CC	0.62	0.67	0.33	0.60
21	FARM MACH & EQUIPMENT	9.42E 02	4.55E 01	3.91E 00	1.12E 01	1.20E 01	2.09	2.36	1.17	2.18
22	COMMUNICATION & OTHER ELECT EQ	5.89E 03	2.01E 02	2.23E 01	6.04E 01	6.63F 01	9.22	13.48	6.31	12.01
23	MOTOR VEHICLES & EQUIP	7.17E 02	4.47E 01	3.49E 00	1.02E 01	1.15E 01	2.05	2.11	1.07	2.08
24	AIRCRAFT & PARTS	8.43E 03	2.91E 02	3.70E 01	8.56E 01	8.24E 01	13.36	22.36	8.94	14.91
25	OTHER TRANSPORTATION EQUIPMENT	1.12E 03	7.43E 01	5.79E 00	1.66E 01	1.83E 01	3.41	3.50	1.73	3.31
26	PROF SCIENTIFIC & OPTICAL INSTR	7.25E 02	3.21E 01	3.11E 00	9.33E 00	9.81E 00	1.47	1.88	0.97	1.78
27	AIR PASSENGER TRANSPORTATION	4.20E 02	6.64E 01	6.30E-01	6.11E 01	3.70E 00	3.05	0.38	6.38	0.67
28	AIR CARGO TRANSPORTATION	1.87E 02	6.01E 01	2.81E-01	5.71E 01	1.65E 00	2.76	0.17	5.97	0.30
29	VESSEL TRANSPORTATION	9.53E 02	1.53E 02	1.62E 00	1.36E 02	7.63E 00	7.02	0.98	14.21	1.38
30	RAIL AND MOTOR TRANSPORTATION	4.59E 01	3.48E 00	8.71E-02	2.70E 00	3.94E-01	0.16	0.05	0.28	0.07
31	GENERAL TRANSPORTATION	1.42E 03	1.61E 02	2.71E 00	1.20E 02	2.96E 01	7.39	1.63	12.54	5.36
32	ELECTRIC, GAS, WATER	3.49E 02	5.69E 00	6.14E-01	3.02E 00	1.62E 00	0.26	0.37	0.32	0.29
33	COMMUNICATION EXC RADIO, TV	2.71E 02	2.34E 01	4.05E 00	4.20E 00	1.21E C1	1.07	2.45	0.44	2.19
34	WHOLESALE, RETAIL	9.59E 02	2.72E 01	2.62F 00	1.44E 01	7.77E 00	1.25	1.58	1.50	1.41
35	FINANCE	9.44E 01	1.60E 00	1.51F-C1	7.12E-01	5.22E-01	0.07	0.09	0.07	0.09
36	SERVICES	1.77E 03	4.59E 01	5.66E 00	2.10E 01	1.69E 01	2.29	3.42	2.20	3.05
37	GOV'T ENTERPRISE	8.50E 01	2.77E 00	2.22F-01	1.29E 00	1.01E 00	0.13	0.13	0.13	0.18
38	IMPORT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.79E 04	2.18F 03	1.66E 02	9.57E 02	5.52E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.56E 04	1.52E 03	1.41E 02	4.89E 02	4.45E 02	69.92	85.05	51.05	80.60
	TRANSPORTATION TOTAL	3.07E 03	4.45E 02	5.33E 00	3.77E 02	4.30E 01	20.42	3.22	39.38	7.79
	ALL OTHERS	5.26E 03	2.10F 02	1.94E 01	9.16E 01	6.42E 01	9.66	11.73	9.57	11.61

Table 39

DIRECT ENERGY USED BY SECTORS TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND IN 1969

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (10 ¹² BTU)	ELECTRIC (10 ¹² BTU)	OTL (10 ¹² BTU)	GAS (10 ¹² BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.95E 02	2.72E 00	1.60E-01	2.14E 00	3.28E-01	0.32	0.30	0.39	0.19
2	MINING	3.47E 01	1.70E 00	2.05E-01	2.44E-01	3.67E-02	0.20	0.39	0.04	0.02
3	CONSTRUCTION	1.50E 03	2.04E 01	5.60E-01	1.87E 01	1.09E 00	2.40	1.06	3.41	0.64
4	CRONANCE	6.53E 03	3.42E 01	8.25E 00	4.52E 00	9.20E 00	4.04	15.68	0.82	5.39
5	FOOD KINDRED & TCEACCC	1.16E 03	1.32E 01	1.04E 00	3.43E 00	5.21E 00	1.56	1.97	0.62	3.05
6	FABRICS & TEXTILES	1.77E 02	2.33E 00	4.48E-01	6.27E-01	4.78E-01	0.27	0.85	0.11	0.28
7	APPAREL & FABRICATED TEXTILES	3.15E 02	8.61E-01	1.58E-01	3.66E-01	1.84E-01	0.10	0.30	0.07	0.11
8	LUMBER, WOODEN CONTAINERS	2.11E 01	1.43E-01	2.99E-02	5.49E-02	4.78E-02	0.02	0.06	0.01	0.03
9	FURNITURE	2.73E 01	1.71E-01	2.79E-02	3.54E-02	5.21E-02	0.02	0.05	0.01	0.03
10	PAPER & PAPER PRODUCTS	4.43E 01	1.91E 00	1.19E-01	4.11E-01	5.78E-01	0.22	0.23	0.07	0.34
11	PRINTING	1.89E 02	6.54E-01	1.62E-01	2.73E-01	1.88E-01	0.08	0.31	0.05	0.11
12	CHEMICALS, PLASTICS, DRUGS, ETC	6.09E 02	8.22E 01	8.59E 00	1.69E 01	3.35E 01	9.70	16.32	3.07	19.59
13	PETROLEUM REFINING & PRODUCTS	1.44E 03	1.69E 02	2.55E 00	1.16E 02	4.84E 01	15.89	4.84	21.17	28.32
14	RUBBER & MISC. PLASTIC PRODUCTS	1.61E 02	2.24E 00	3.59E-01	4.95E-01	4.76E-01	0.26	0.68	0.09	0.28
15	LEATHER, TANNING, FOOTWEAR	7.12E 01	1.85E-01	3.86E-02	9.01E-02	2.00E-02	0.02	0.07	0.02	0.01
16	GLASS, STONE & CLAY PRODUCTS	2.64E 01	2.03E 00	1.11E-01	9.61E-01	1.64E 00	0.24	0.21	0.04	0.75
17	PRIMARY IRON & STEEL MANUF	6.49E 01	5.02E 00	2.90E-01	9.61E-01	1.64E 00	1.06	0.55	0.18	0.96
18	PRIMARY NONFERROUS MANUF	8.24E 01	3.31E 00	8.91E-01	4.43E-01	7.57E 00	0.39	1.69	0.11	1.02
19	METAL CONTAINER, WELDING, STAMP	2.47E 02	1.99E 00	3.64E-01	6.24E-01	1.73E 00	0.23	0.69	0.08	0.44
20	ENGINES & TURBINES	2.20E 02	2.25E 00	2.57E-01	5.57E-01	3.55E-01	0.27	0.49	0.10	0.21
21	FARM MACH & EQUIPMENT	9.42E 02	4.94E 00	8.97E-01	1.53E 00	1.37E 00	0.58	1.71	0.28	0.80
22	COMMUNICATION & OTHER ELECT EQ	5.85E 03	3.28E 01	5.34E 00	1.08E 01	1.28E 01	3.87	10.15	1.96	7.51
23	MOTOR VEHICLES & EQUIP	7.17E 02	3.27E 00	5.82E-01	5.08E-01	7.99E-01	0.39	1.11	0.09	0.47
24	AIRCRAFT & PARTS	8.43E 03	3.58E 01	1.07E 01	1.41E 01	5.84E 00	4.22	20.26	2.57	3.42
25	OTHER TRANSPORTATION EQUIPMENT	1.12E 03	7.88E 00	1.27E 00	1.27E 00	1.59E 00	0.93	2.42	0.23	0.93
26	PROF SCIENTIFIC & OPTICAL INSTR	7.25E 02	5.16E 00	5.81E-01	1.84E 00	8.45E-01	0.61	1.10	0.33	0.49
27	AIR PASSENGER TRANSPORTATION	4.20E 02	5.47E 01	1.01E-01	5.39E 01	7.10E-01	6.45	0.19	9.82	0.42
28	AIR CARGO TRANSPORTATION	1.87E 02	5.49E 01	4.49E-02	5.45E 01	3.16E-01	6.47	0.09	9.93	0.18
29	VESSEL TRANSPORTATION	9.53E 02	1.27E 02	3.43E-01	1.22E 02	8.58E-01	14.98	0.65	22.22	0.50
30	RAIL AND MOTOR TRANSPORTATION	4.59E 01	2.19E 00	2.75E-02	2.01E 00	6.88E-02	0.26	0.05	0.37	0.04
31	GENERAL TRANSPORTATION	1.42E 03	1.21E 02	8.54E-01	9.89E 01	1.94E 01	14.27	1.62	18.01	11.35
32	COMMUNICATION EXC RADIO, TV	3.49E 02	3.20E 00	4.17E-01	1.90E 00	8.74E-01	0.38	0.79	0.35	0.51
33	ELECTRIC, GAS, WATER	2.71E 02	1.21E 01	2.83E 00	1.15E 00	7.82E 00	1.42	5.38	0.21	4.58
34	WHOLESALE, RETAIL	5.59E 02	1.45E 01	1.62E 00	9.17E 00	3.76E 00	1.72	3.08	1.67	2.20
35	FINANCE	9.44E 01	3.37E-01	5.63E-02	1.19E-01	1.62E-01	0.04	0.11	0.02	0.09
36	SERVICES	1.77E 03	1.48E 01	1.98E 00	6.69E 00	6.09E 00	1.74	3.76	1.22	3.56
37	GCV-T ENTERPRISE	8.50E 01	3.19E 00	3.49E-01	9.56E-01	1.88E 00	0.38	0.66	0.17	1.10
38	IMPORT	0.0	C-0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	0.0	C-0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GCV-T COMPENSATION	0.0	C-0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	3.79E 04	8.48E 02	5.26E 01	5.49E 02	1.71E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	2.56E 04	4.15E 02	4.30E 01	1.76E 02	1.27E 02	48.98	81.73	32.09	74.54
	TRANSPORTATION TOTAL	3.03E 03	3.60E 02	1.44E 00	3.32E 02	2.15E 01	42.42	2.73	60.43	12.56
	ALL OTHERS	5.26E 03	7.29E 01	8.17E 00	4.11E 01	2.20E 01	8.60	15.54	7.48	12.90

Table 40

ENERGY CONSUMED IN 1969 BY ULTIMATE USER TO PRODUCE DEPARTMENT OF DEFENSE FINAL DEMAND

SIC	SECTOR	PURCHASES (\$ MILLIONS)	TOTAL (1012 BTU)	ELECTRIC (1012 BTU)	OIL (1012 BTU)	GAS (1012 BTU)	% TOTAL	% ELECT	% OIL	% GAS
1	AGRICULTURE	1.45E 03	2.23E 01	1.16E 00	1.78E 01	2.72E 00	1.02	0.69	1.84	0.49
2	MINING	1.76E 03	1.27E 02	6.15E 00	9.30E 00	1.99E 01	5.79	3.66	0.96	3.56
3	CONSTRUCTION	2.13E 03	3.28E 01	8.51E 01	3.03E 01	1.65E 00	1.50	0.51	3.15	0.30
4	CRANANCE	7.38E 03	3.64E 01	8.78E 00	4.81E 00	8.80E 00	1.66	5.23	0.50	1.76
5	FOOD KINDRED & ICEACCC	1.90E 03	2.14E 01	1.68E 00	5.55E 00	8.44E 00	0.98	1.00	0.58	1.51
6	FABRICS & TEXTILES	7.27E 02	5.42E 00	1.81E 00	2.52E 00	1.95E 00	0.43	1.08	0.26	0.35
7	APPAREL & FABRICATED TEXTILES	4.57E 02	1.35E 00	2.50E 01	5.66E 01	2.90E 01	0.06	0.15	0.06	0.05
8	LUMBER, WOODEN CONTAINERS	4.55E 02	4.02E 00	6.61E 01	1.81E 00	1.24E 00	0.18	0.39	0.19	0.22
9	FURNITURE	1.59E 02	1.22E 00	2.00E 01	3.23E 01	2.95E 01	0.06	0.12	0.03	0.05
10	PAPER & PAPER PRODUCTS	8.58E 02	5.08E 01	2.94E 00	1.07E 01	1.52E 01	2.32	1.75	1.11	2.73
11	PRINTING	9.32E 02	3.23E 00	7.98E 01	1.35E 00	9.26E 01	0.15	0.48	0.14	0.17
12	CHEMICALS, PLASTICS, DRUGS, ETC	2.25E 03	2.71E 02	2.69E 01	6.24E 01	1.05E 02	12.36	16.00	6.47	18.77
13	PETROLEUM REFINING & PRODUCTS	2.24E 03	2.63E 02	3.97E 00	1.81E 02	7.54E 01	11.98	2.36	18.79	13.51
14	RUBBER & MISC. PLASTIC PRODUCTS	8.15E 02	1.13E 01	1.82E 00	2.51E 00	2.41E 00	0.52	1.08	0.26	0.43
15	LEATHER, TANNING, FOOTWEAR	1.16E 02	8.63E 01	7.52E 02	3.38E 01	1.63E 01	0.04	0.04	0.04	0.03
16	GLASS, STONE & CLAY PRODUCTS	5.19E 02	4.03E 01	2.20E 00	4.22E 00	2.50E 01	1.84	1.31	0.44	4.49
17	PRIMARY IRON & STEEL MANUF	2.38E 03	3.31E 02	1.06E 01	3.52E 01	6.02E 01	15.08	6.32	3.65	10.80
18	PRIMARY NONFERROUS MANUF	2.48E 03	9.97E 01	2.68E 01	1.33E 01	5.22E 01	4.55	15.97	1.38	9.36
19	METAL CONTAINER, MCLING, STAMP	2.01E 03	1.72E 01	2.82E 00	5.62E 00	6.56E 00	0.78	1.68	0.58	1.17
20	ENGINES & TURBINES	3.85E 02	3.94E 00	4.51E 01	9.77E 01	6.23E 01	0.18	0.27	0.10	0.11
21	FARM MACH & EQUIPMENT	3.16E 03	1.83E 01	3.58E 00	6.17E 00	5.42E 00	0.83	2.13	0.64	0.97
22	COMMUNICATION & OTHER ELCT EQ	9.94E 03	5.62E 01	1.03E 01	1.89E 01	2.04E 01	2.56	6.11	1.96	3.56
23	MOTOR VEHICLES & EQUIP	1.35E 03	6.14E 00	1.09E 00	9.54E 01	1.50E 00	0.28	0.65	0.10	0.27
24	AIRCRAFT & PARTS	1.28E 04	5.45E 01	1.62E 01	2.14E 01	8.88E 00	2.48	9.66	2.22	1.59
25	OTHER TRANSPORTATION EQUIPMENT	1.32E 03	9.26E 00	1.50E 00	1.50E 00	1.87E 00	0.42	0.89	0.16	0.33
26	PROF SCIENTIFIC & OPTICAL INSTR	1.50E 03	5.43E 00	1.22E 00	3.13E 00	1.69E 00	0.43	0.73	0.33	0.30
27	AIR PASSENGER TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28	AIR CARGO TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29	VESSEL TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30	RAIL AND MOTOR TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
31	GENERAL TRANSPORTATION	4.75E 03	5.06E 02	2.48E 00	4.52E 02	4.50E 01	23.10	1.47	46.84	8.07
32	COMMUNICATION EXC RADIO, TV	1.64E 03	8.83E 00	1.23E 00	5.04E 00	2.56E 00	0.40	0.73	0.52	0.46
33	ELECTRIC, GAS, WATER	1.29E 03	5.76E 01	1.35E 01	5.47E 00	3.73E 01	2.63	8.04	0.57	6.69
34	WHOLESALE, RETAIL	3.06E 03	4.64E 01	5.16E 00	2.92E 01	1.20E 01	2.12	3.07	3.03	2.15
35	FINANCE	2.16E 03	5.60E 00	1.67E 00	3.44E 00	4.49E 00	0.44	0.99	0.36	0.81
36	SERVICES	4.80E 03	4.64E 01	7.26E 00	2.17E 01	1.75E 01	2.12	4.32	2.25	3.13
37	GOV'T ENTERPRISE	6.49E 02	1.62E 01	1.85E 00	4.76E 00	9.57E 00	0.74	1.10	0.49	1.71
38	IMPORT	1.42E 03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
39	OTHER	7.86E 02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40	GOV'T COMPENSATION	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	8.16E 04	2.19E 03	1.68E 02	9.64E 02	5.58E 02	100.00	100.00	100.00	100.00
	MANUFACTURING TOTAL	5.63E 04	1.32E 03	1.27E 02	3.85E 02	4.05E 02	60.16	75.40	39.98	72.63
	TRANSPORTATION TOTAL	4.75E 03	5.06E 02	2.48E 00	4.52E 02	4.50E 01	23.10	1.47	46.84	8.07
	ALL OTHERS	2.05E 04	3.67E 02	3.88E 01	1.27E 02	1.08E 02	16.74	23.12	13.18	19.30

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